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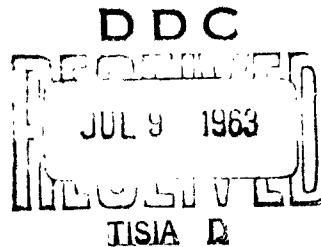
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COLLECTION OF REPORTS  
ON  
VIBRATION SURVEYS  
ISSUED DURING 1962

## TECHNICAL REPORT

DESIGN DIVISION  
NEW YORK NAVAL SHIPYARD  
BROOKLYN 1, NEW YORK



3ND-NYNS-200-P.9



COLLECTION OF REPORTS  
ON  
VIBRATION SURVEYS  
ISSUED DURING 1962

ADMINISTRATIVE SUPPORT BRANCH  
DESIGN DIVISION  
NEW YORK NAVAL SHIPYARD  
BROOKLYN 1, NEW YORK

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*L. J. Moore*

## INTRODUCTION:

Vibration surveys conducted by the Planning Department, Design Division, of the New York Naval Shipyard, in response to ship and yard requests are summarized in brief reports which are not normally distributed to the Bureau of Ships or other Naval activities. It is believed the data contained in these reports could be of interest to the Bureau of Ships and of value to the various government activities indicated on the distribution list.

In accordance with Chief, Bureau of Ships Instruction 9400.9 of 4 October 1961 this summary report of all vibration surveys conducted by the Design Division of the New York Naval Shipyard is forwarded herewith for information and file.

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UNDERWAY VIBRATION SURVEY  
HULL AND MAIN PROPULSION MACHINERY  
USS HARWOOD (DDE 861)

VIBRATION SURVEY REPORT 240-18  
28 DEC 1961

by

O. Ritter & H. Kuritzky

APPROVAL INFORMATION

Authority: J.O. 30-273-8100-99  
D.S. 8913

Prepared by                      Checked by                      Approved by                      Date

H. Kuritzky *[Signature]*

O. Ritter OKR

*A.P. [Signature]*

*X. [Signature]*

1/8/62

*A.P.* Branch Head 264

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CO USS HARWOOD (DDE 861) (2)  
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212(3)                      273A  
245(2) Tech. Lib. w/orig



1. Brief Summary:

An underway vibration survey was conducted on the hull, main turbines, reduction gears, shafting and propellers during the sea trial of the USS HARWOOD (DDE 861). The ship embarked from the New York Naval Shipyard at 0730 on 28 Dec. 1961 and returned the same evening at 2000.

The results indicated that there were no excessive vibrations in the areas inspected.

2. Personnel Contacted:

LTJG O'Neil	Eng. Off. USS HARWOOD (DDE 861)
LTJG Fritche	Ship Supt. USS HARWOOD (DDE 861)

3. Details of Survey:

Data in the main propulsion machinery room was taken with an Askania hand vibrograph with a 20:1 magnification ratio. Data was recorded at all bearings on the main propulsion machinery in the three principal directions while at approximately 315SRPM.

Data on the hull was taken with an Askania universal vibrograph with a 20:1 magnification ratio. Hull data was recorded in the gun director located at 02-74-0.

4. Results:

a. Analysis of main propulsion machinery data do not indicate excessive vibration. However, large, but not excessive vibrations were recorded in the area of the H.P. turbine in engine room no. 2.

b. Hull data recorded in the gun director also indicated satisfactory operation.

5. Recommendations:

a. It is recommended that because of the "large" vibrations recorded in the vicinity of the H.P. turbine in engine no. 2 (as noted in para. 4), a further study be made during the sonar noise survey trials. This survey will serve to validate the data taken on 28 Dec. 1961.

b. Hull - No work required.

6. Advance information was given to code 212, P. and E. on 2 Jan. 1962.

UNDERWAY VIBRATION SURVEY  
H.P., L.P. AND CRUISING TURBINES  
USS HARWOOD (DDE 861)

VIBRATION SURVEY REPORT 240 - 19  
11, 12 Jan 1962

by

O. Ritter and H. Kuritzky

APPROVAL INFORMATION

Authority: DAR No. 9800

Reference: (a) Vibration Survey Report 240-18,  
28 Dec 1961

Prepared by:

Checked by:

Approved by: I

H. Kuritzky

O. Ritter

OK

A. Jansson

R. M. Schan 11

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1. Brief Summary:

An underway vibration survey was conducted in the aft engine room (#2) during the sea trial of the USS HARWOOD (DDE86). The ship embarked from the New York Naval Shipyard at 0745 on 11 Jan 1962 and returned at 1400 on 12 Jan 1962.

The results indicated that there were no excessive vibrations in the areas inspected.

Note: This survey was conducted on the recommendation of ref. (a).

2. Personnel Contacted:

LTJG O'Neil  
LTJG Fritche

Eng. Off. USS HARWOOD (DDE861)  
Ship Supt.

3. Details of Survey:

Data in the aft main propulsion machinery room (#2) was taken with an Askania hand vibrograph with a 20:1 magnification ratio. Data was recorded at all bearings and on the foundation of the H. P., L. P. and cruising turbines. Data was taken in the three principal directions while at approximately 80% full power.

4. Results:

a. Analysis of data verify the conclusions of ref. (a). That is, no excessive vibration was found.

5. Advance information was given to Code 244D on 16 Jan 1962.

VIBRATION SURVEY OF  
USS CONSTELLATION (CVA64)  
DURING BUILDERS & PAT TRIALS

21-22 & 27-30 NOV 1961

VIBRATION SURVEY REPORT NO. 240 - 20

BY

ANTHONY M. DELLATTO (CODE 251D)  
JOSEPH MANGANARO (CODE 251D)

APPROVAL INFORMATION

Prepared by

J. Manganaro

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*R.H. Fritchard*  
R.H. Fritchard  
251D *R.H. Fritchard*  
251 *R.H. Fritchard*

Date

1/30/6

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### ABSTRACT

A vibration survey was conducted by Design Personnel to determine the vibratory characteristics of the Hangar Deck and other Decks Aft, the engine stowage area (02 Level Aft) and the Island (08 and 09 Levels), of the USS CONSTELLATION during her Sea Trials.

Based upon the results of the investigation, the following conclusions are drawn:

a. The vibratory amplitudes of the Main Deck from Frame 215-244 and other Decks in the Aft Section of the Ship were within the acceptable amplitudes for this Class Vessel.

b. Vibratory Amplitudes in Flag Plot (08 Level) and the Bridge (09 Level) were above the average experienced in this area for this Class Vessel. Additional Stiffening of the cantilevered structure is recommended.

c. The vibratory amplitudes of the Deck in the Jet Engine stowage area were moderate, but the exist, shock mounting system, on which the engine is supported, magnifies the deck amplitudes to a level which is not acceptable for the engine.

### SUMMARY:

A vibration survey was conducted on various decks of the USS CONSTELLATION (CVA64) during her Sea Trials (Builders and P.A.T.). To determine the maximum amplitudes of vibration and to compare them with the accepted values of other vessels of the Class.

Hull Records were taken during build-up to full power at full power (130-167 RPM).

## SUMMARY (CONT'D)

The results indicate no excessive vibration on the main deck or other decks except in the Island Structure (08 and 09 levels). The Jet Engine (J-71) as stowed, vibrated excessively on the exist. shock mounts. The exist. shock mounts have a tendency to amplify and transmit to the engine the 5th order vibration present in the Aft portion of the ship.

## ADMINISTRATIVE INFORMATION

1. **AUTHORITY:** Design Log #2005

REF. (a) Plan No. CVA64-1351430 - Alt. "K"

2. **INTRODUCTION:**

A vibration survey was conducted on the USS CONSTELLATION (CVA64) during her builders and P.A.T. Trials to record Amplitudes of Vibration. From 130 RPM to 167 RPM (Full Power). Vibratory readings were recorded by means of an Universal Askania Vibrograph or a hand Askania Vibrograph, where no readings could be obtained with the "Universal". The survey was primarily conducted in areas of the ship which exhibited excess amplitudes of vibrations on other vessels of the class.

3. **DESCRIPTION**

The subject vessel is similar to a FORRESTAL Class Aircraft Carrier equipped with five (5) bladed propellers, on all four (4) shafts.

4. **PROCEDURE**

(a) The Vibration Survey was geared to the ship's build-up to full power and sustained full power endurance run (about four (4) hours). All readings were taken by either an Askania Universal Vibrograph, or where it was not feasible, an Askania Hand Vibrograph (Both at 20:1 Magnification).

(b) **PHASE I** - In order to determine the Vibratory characteristics of the Hangar Deck a traverse of the deck was made. The area covered, extended from frame 215-244. Readings were taken on the 2 Long'l., other Long'ls, between Long'ls and at Trans. frames (See Figures I(a) and I(d)).

(c) **PHASE II** - A traverse of the Jet Engine Stowage Platform (02 level) was made to determine the Vibratory characteristics of the deck and also of the stowage rack. Readings were taken with the engine stowed (See Fig. II(a)).



#### 4. PROCEDURE (CONT'D)

(d) PHASE III - Excessive vibratory amplitudes were reported during Sea Trials on USS KITTY HAWK (CVA63). In Flag Plot (08 Level) and the Bridge (09 Level). A survey of these levels was made to determine whether excessive vibration was present on the CVA64 (See Fig. III(a) and III(b)).

#### 5. CONCLUSIONS AND RECOMMENDATIONS

##### PHASE I

a. The results of this survey summarized in Tables I(a) and I(b) indicate a 5th order peak amplitude of (+ 13 MILS, in one area during full power. This Amplitude of Vibration is moderate for this Class Carrier. In general Amplitudes are much lower than this, over the entire area.

b. The same comments as (a), apply for the Gallery Deck (See Table I(c)).

PHASE II - The Vibratory Amplitudes recorded on the deck were moderate not exceeding (+ 5 MILS) (See Table II(a)). But the shock mount system (includes "C" Mount and Engine Mount), on which the engine is mounted, amplify the deck amplitudes to a level which is not acceptable for the engine. i.e. An Amplitude of (+ 18 MILS) which may cause the malfunctioning on some parts of the engine.

Representatives from BUWEPS and BUSHIPS who were present during the trials indicated that a new study of the shock mount system will be made to correct this condition.

PHASE III - The results of this phase of survey (summarized in tables III(a) and III(b)) indicate that the amplitude of vibration near the Island Bulkheads are moderate (+ 2 MILS) increasing as expected toward the free end of the bridge and flag plot. The maximum amplitude recorded at these points is (+ 23 MILS) at 145 and dropping off to (+ 6 MILS) at 167 RPM (Full Power). The maximum amplitude of vibration recorded is considered excessive from the standpoint of being uncomfortable, since it occurs in an area which is constantly manned by personnel who are engaged in the navigation of the ship. Moreover, the peak amplitude occurs close to the air operation speed.

In order to reduce the vibratory amplitudes, the exist trusses below the flag plot should be extended to the Bulkhead. See Rev. (a), (Plan No. CVA64-1351430, Alt. "K").

DATE: 12/21/6

BY: J.M.

[illegible]

TABLE I(a)

## VIBRATION: SURVEY CALCULATION

# WORK SHEET

DATE: 12/21/61

U.S.S. CONSTELLATION (CV-64)

BY: J.M.

[illegible]

TABLE I(b)



Fig. 7/6)

4385 concentration (continued)

5281071 16 2112 62332 8804 1981

1. What is the purpose of the study?

no other  
deck of cards anywhere in 12,000

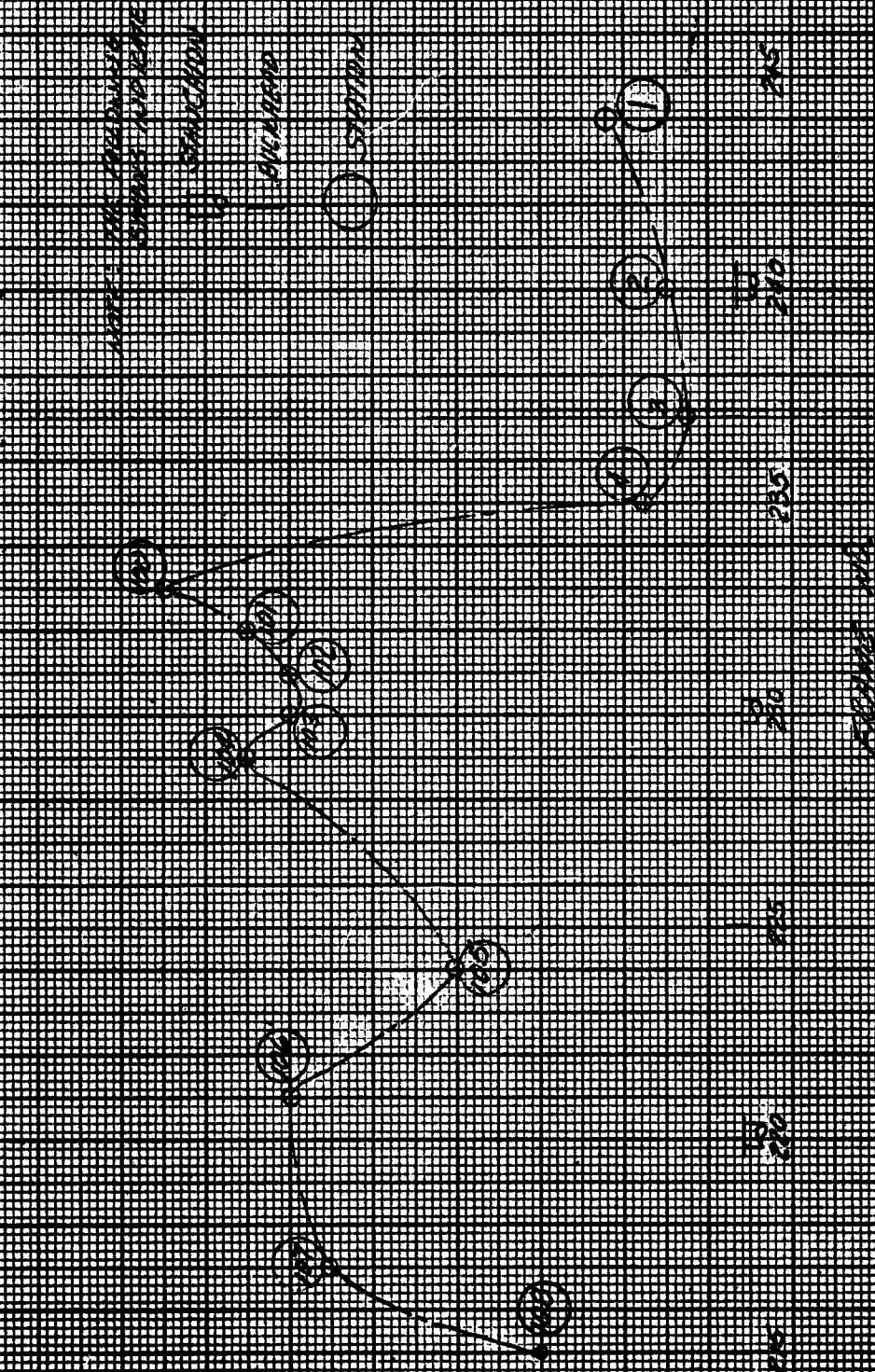


FIG. 1(b)

FIG. 16

65 CONSTITUTION (CUNARD)

VIBRATION SURVEY OF 11-228-27-10 NOV 1961

3RD ORDER VERTICAL VIBRATION ON OVER FRAME 243

ON MAIN DECK (AT WARTSHIP TRANSVERSE) AT

FULL POWER (147 RPM)

NOTES: THE FOLLOWING  
SYMBOLS IN DIVERTS

LONGITUDINAL

STATIONS

STATIONS

LONGITUDINAL VIBRATION

TRANSVERSE VIBRATION

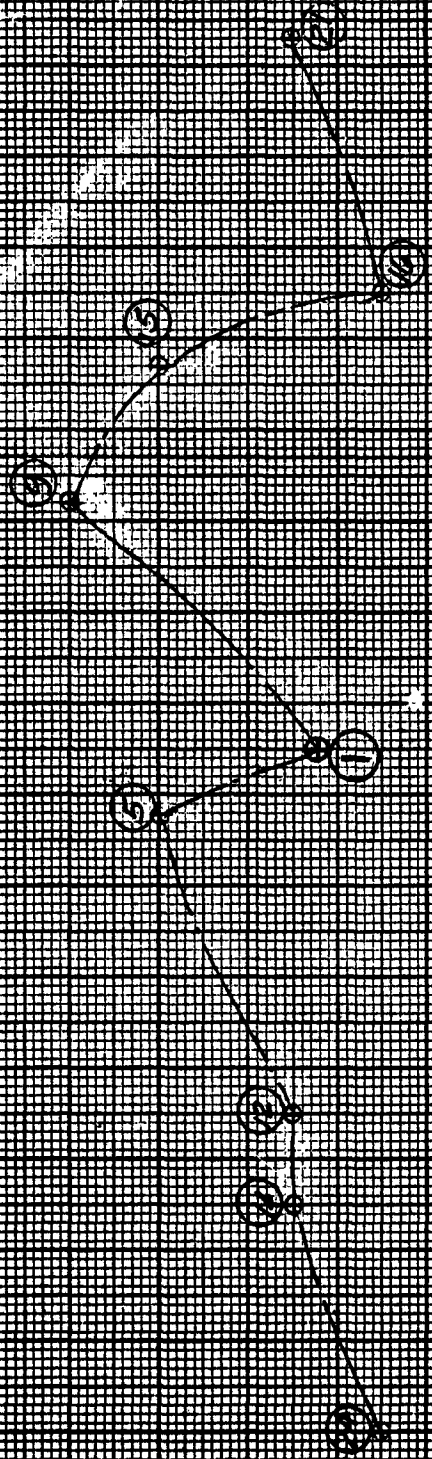


FIG. 16C)

## VIBRATION: SURVEY CALCULATION

# WORK SHEET

DATE : 12/21

U.S.S. CONSTELLATION (CVA 64)

BY: JWL

[illegible]

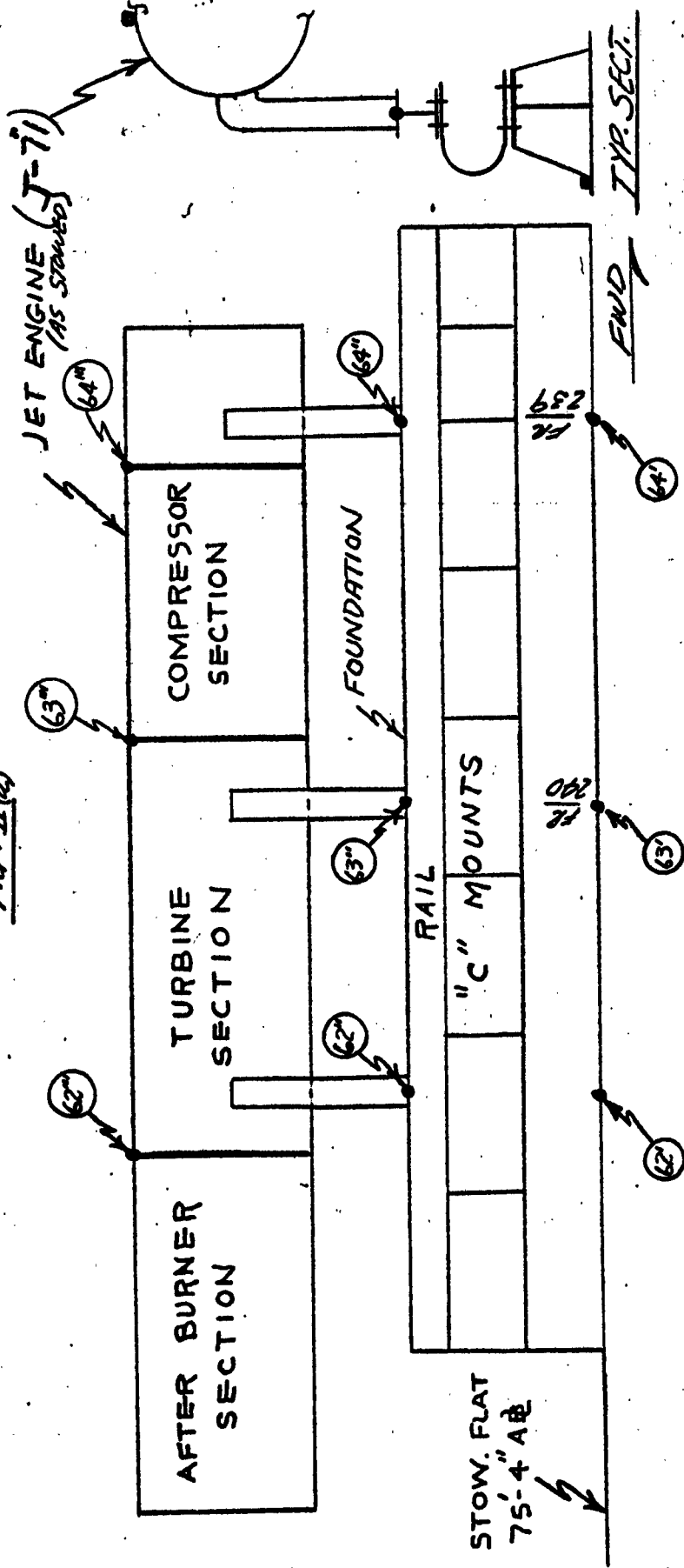
USS CONSTELLATION (CVA 64)

VIBRATION SURVEY OF 21-22 & 27-30 NOV. 1961

5<sup>TH</sup> ORDER VERTICAL VIBRATION IN JET ENGINE STOWAGE

FEAT AT FULL POWER (167 RPM)

FIG. II(2)



# TYPICAL JET ENGINE STOWAGE COMPARTMENT WITH ENGINE STOWED

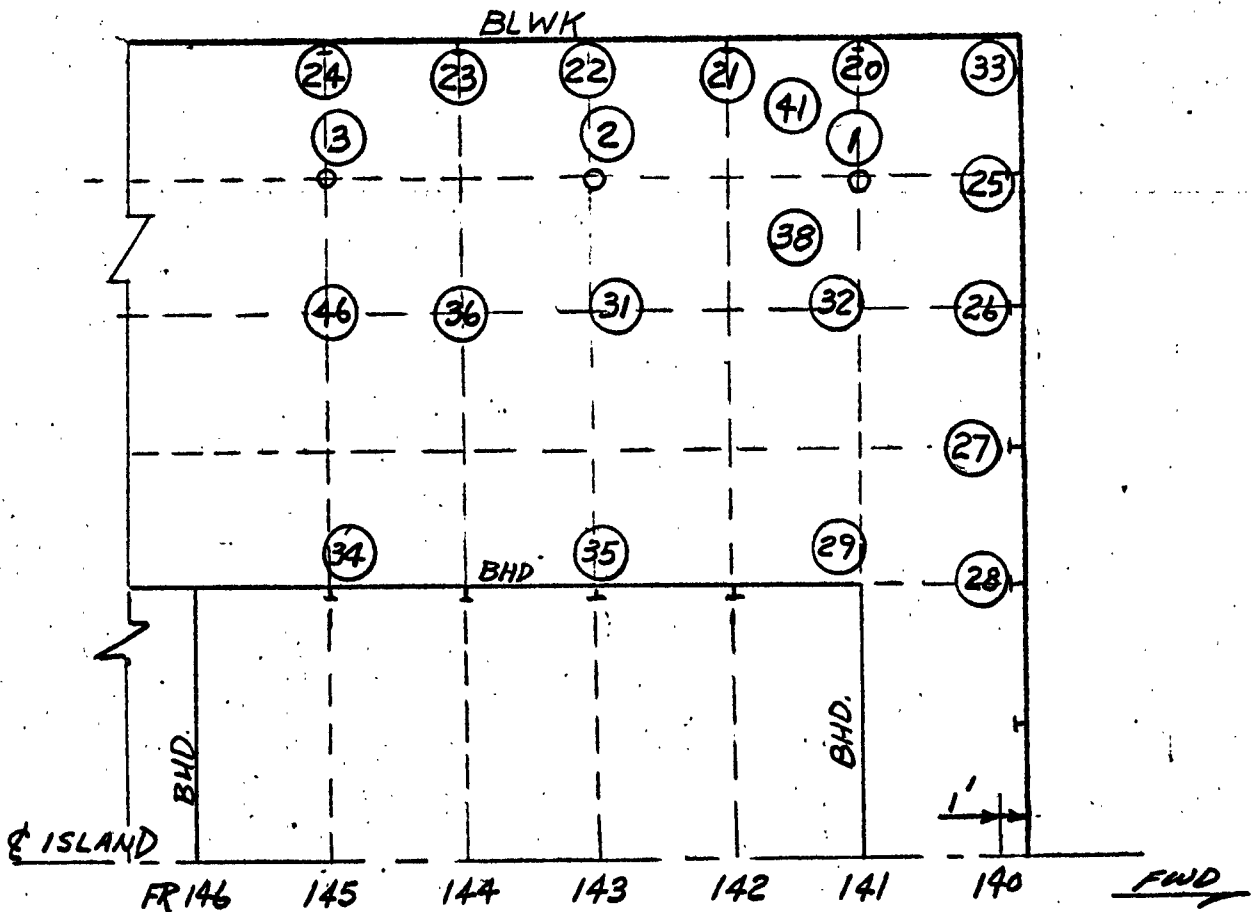
NOTE:

(1) SINGLE PRIMES INDICATE READING AT FOOT OF FOUNDATION



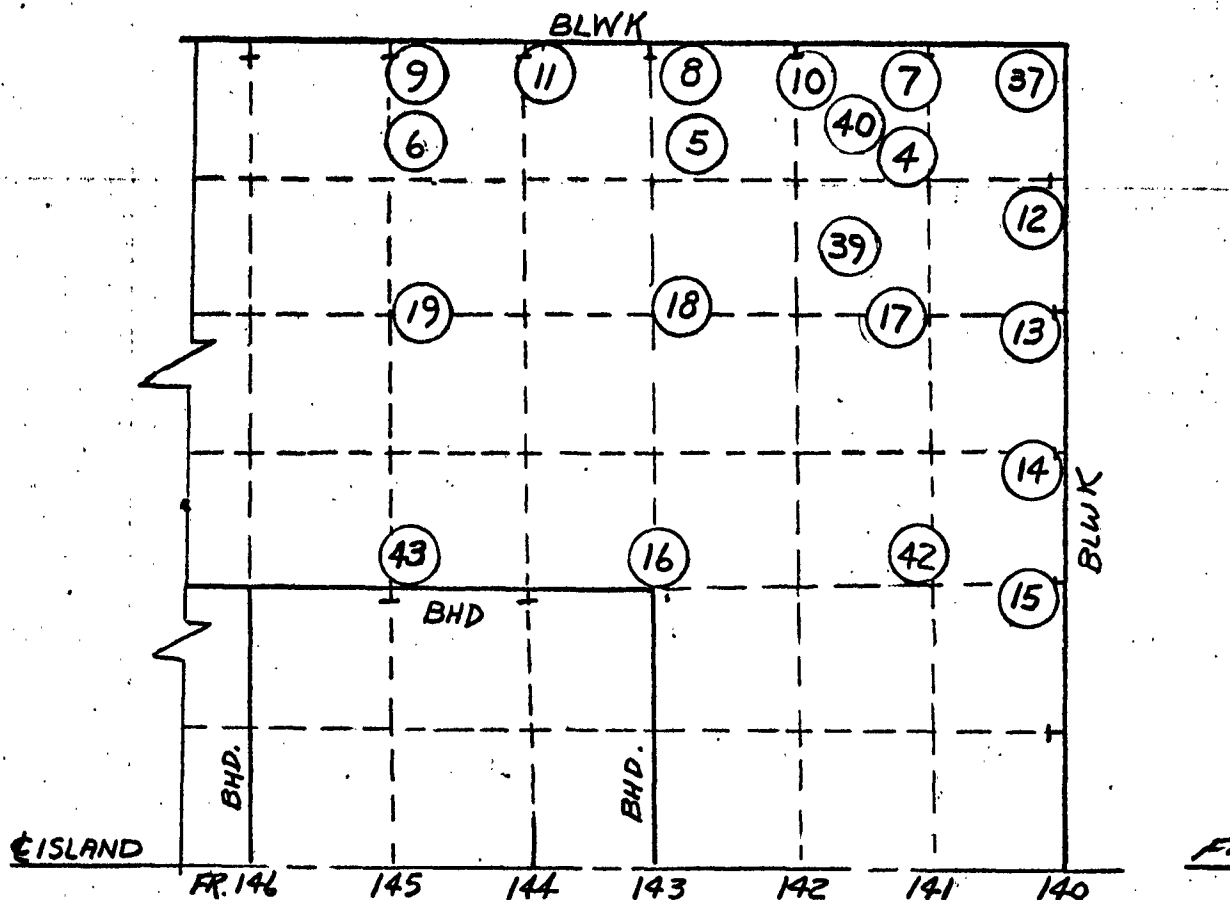


FIG III(a)  
USS CONSTELLATION (CVA64)  
VIBRATION SURVEY OF 21-22 & 27-30 NOV. 1961  
LOCATION OF READINGS ON FLAG PLOT (OBLEV.)  
 (FLAG PLOT)



PLAN VIEW AT FLAG PLOT (OBLEV.)

FIG. IV(b)  
USS CONSTELLATION (CVA 64)  
VIBRATION SURVEY OF 21 & 22 & 27-30 NOV. 1961  
LOCATION OF READINGS ON BRIDGE 09 LEV.



PLAN VIEW AT BRIDGE 09 LEV.



FIG. III(c)

100 CONSTITUTION (CVA 54)  
 VARIATION OF 21-22 (27-30) VARIATION  
 OF OTHER VARIATION VARIATION OF 21-22  
 BETWEEN 100 DEGREE RANGE OF BULWARK (WEAK  
 CAPABILITY) ON 09-15-1961 AT VARIABLE RPM

DISPLACEMENT AND TORSION

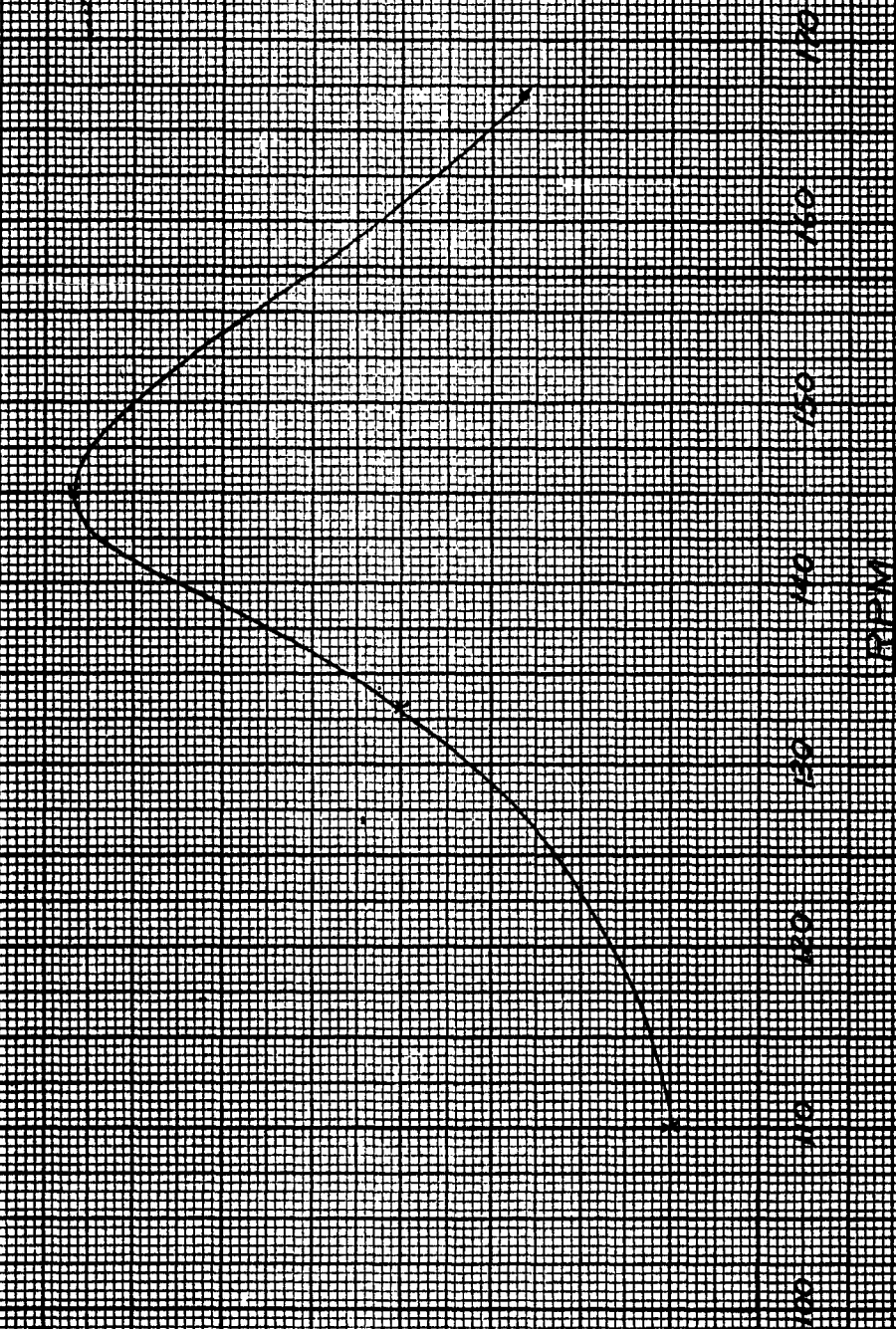


FIG. III(d)

DOCKSIDE VIBRATION SURVEY  
NO. 1 100KW DIESEL GENERATOR  
USS SHELDRAKE (AGS-19)  
18 JAN 1962

VIBRATION SURVEY REPORT 240-21

by

A. Isaacson and A. Algaze

APPROVAL INFORMATION

Authority: J.O. 25-621-6120-99  
DAR No. 5228

Prepared by:                      Checked by:                      Approved by:                      Date

A. Isaacson *A.I.*

*Algaze*  
20 Jan 62

A. Algaze *Ⓟ*

*K. M. Schan* 1/30/62  
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**1. Brief Summary:**

A dockside vibration survey was conducted on the No. 1 Ship Service 100KW Diesel Generator. The results of the survey indicate a predominant first order vibration which is excessive in the fore and aft directions at both the aft and forward ends of the diesel engine (point C and D on sketch, page 3 ). The data also indicated an excessive vibratory amplitude at forward end of the DC exciter in the vertical and fore and aft directions. (Point A on sketch, page 3 ).

**2. Personnel Contacted:**

ENS. Arnold - Engineering Officer, AGS 19

**3. Details of Survey:**

Vibrations were recorded in the three principal directions at the points indicated on sketch, (page 3 ) utilizing an Askania hand Vibrograph with a 5:1 feeler probe. Readings were taken with the generator operating at no load.

Name plate data:

Diesel Engine: GM Model 3-268A

Generator: G.E. - 125 KVA- 1200 RPM - 0.8 pf  
440 V - 3 phase - 60 cycle

**4. Results:**

The results of the survey indicate excessive vibratory displacement amplitudes at the exciter end and at the top of the diesel engine. The data is tabulated on page 3 .

**5. Conclusions and Recommendations:**

In order to reduce vibration amplitudes to acceptable limits the following checks should be made and corrective action taken where necessary.

a. Check the coupling between the diesel engine and the generator for alignment.

b. Check the D.C. Exciter for the following.

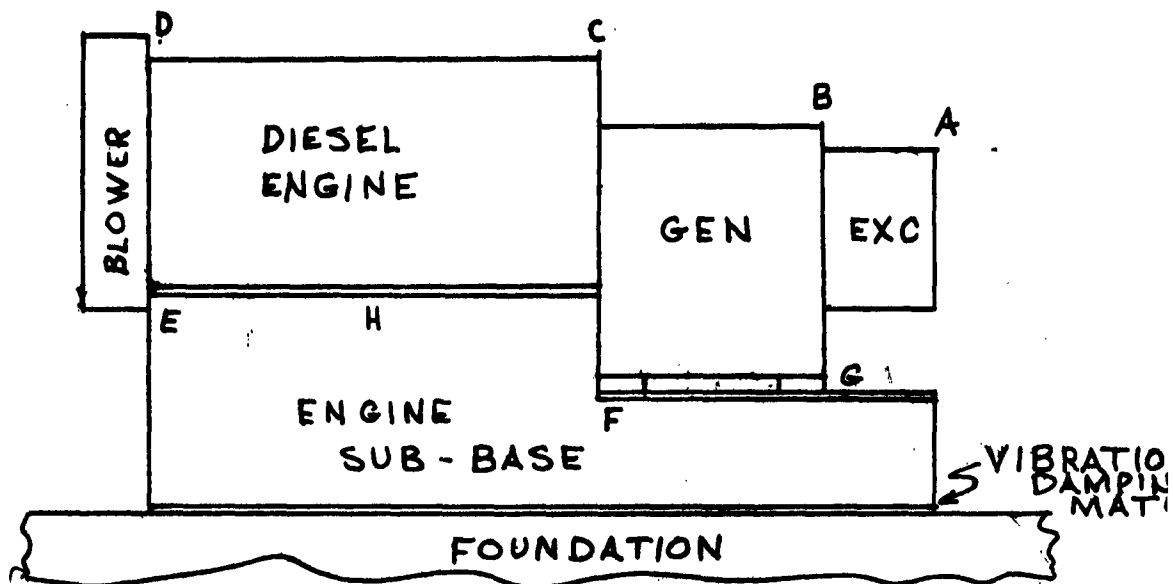
- (1) Correct mounting of housing.
- (2) Alignment.
- (3) Balance of rotor (together with generator rotor).

c. Check foundation and Engine Sub-base for cracks. Check bolting for tightness.

d. Check to insure that vibration isolating material is installed in accordance with manufacturers instructions, that is with proper loading and proper take-up on bolting.



# VIBRATION DATA



STA	VIBR. AMPLITUDE $\pm$ S.A. MILS			CPS	CALC RPM	REMARK
	VERT	ATHW	<del>FA</del> A			
A	17.5	7.5	15.0	21	1260	FIRST ORDE
B	5.0	4.0	4.0	21	1260	
C	4.0	5.0	11.0	20	1200	
D	8.5	2.0	23.0	20	1200	
E	2.0	2.5	—	20	1200	
F	2.0	—	—	21	1260	
G	5.0	—	5.0	21	1260	
H	—	4.0	—	20	1200	
C	4.0	5.0	—	21	1260	
D	—	—	24.0	20	1200	Y

UNDERWAY VIBRATION SURVEY  
HULL AND MAIN PROPULSION MACHINERY  
USS WARE (DDE865)

VIBRATION SURVEY REPORT 240- 22  
2, 3 Feb 1962

by

V. PIERNO and O. RITTER

APPROVAL INFORMATION

Authority: J.O. 13244816099  
D.S. 3823

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Checked by

Approved by Date

V. Pierno VP  
O. Ritter OR

A. Setzer

R. H. H. H. H. H. 2/9/62  
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<b>DISTRIBUTION</b>	<b>Title Page</b>

# **1. Brief Summary:**

Underway vibration readings were taken on the hull, main turbines, reduction gears, shafting and propellers during the sea trial of the USS WARE (DD865). The ship embarked from the New York Naval Shipyard at 0630 on 2 Feb. 1962 and returned at 1500 on 3 Feb. 1962. The hull survey indicates a satisfactory condition with respect to vibration. The main propulsion survey indicates satisfactory conditions at the recorded speeds (280 rpm in machinery room #1 and 247 rpm in machinery room #2). Had the ship gone up to 80% full power (316 rpm) the data indicates that there may be an unsatisfactory condition.

**NOTE:** Rpm refers to shaft revolutions per minute unless otherwise indicated.

# **2. Personnel Contacted:**

LT (JG) Thearle

-Eng. Off. USS WARE (DD865)

# **3. Details of Survey:**

Data in the main propulsion plant machinery rooms was taken with an Askania hand vibrograph with a 20:1 feeler tube. Vibration readings were obtained for all bearings on the main propulsion machinery in the three principal directions at 280 rpm in machinery room #1 and 247 rpm of the shaft in machinery room #2.

The ship did not maintain 80% full power (316 rpm) for any appreciable length of time, therefore, readings at that speed were not taken in the machinery spaces.

An Askania universal vibrograph with a 20:1 magnification ratio was used in the gun director (02-74-0) to obtain hull vibration through the range 87 rpm-340rpm in the athwartship direction.

# **4. Results:**

a. Hull data recorded in the gun director indicated a satisfactory condition with respect to vibration. A maximum single amplitude of 5.25 mils at a speed of 310 rpm was recorded.

b. A single amplitude<sup>OF</sup> vibration of .75<sup>MILS</sup> in the athwartship direction at high pressure turbine frequency (4700 cpm) was found at the cruising turbine reduction gear bearing in machinery room #1 (280 rpm). Had the ship attained 80% full power (316 rpm) the data indicates that the amplitude of vibration may be above the allowable limit.

c. A single amplitude of vibration of .50 mils in the athwartship direction at high pressure turbine frequency (3900 cpm) was found at the cruising turbine reduction gear bearing in machinery room #2 (247 rpm). Had the ship attained 80% full power (316 rpm) the data indicates that the amplitude of vibration may be above the allowable limit.

5. Recommendations:

a. It is recommended that as a result of the vibrations obtained (para 4 above) a full vibration survey be conducted through a range of speeds up to 80% full power (316 rpm) on the two high pressure turbines only, on the next trial.

b. No hull work is required.

6. Advanced information was given to Code 212 P. and E. via Code 244 on 6 Feb 1962.

UNDERWAY VIBRATION SURVEY  
MAIN PROPULSION MACHINERY AND HULL  
USS CONE (DD866)  
(Pre-repair Sea Trial)

VIBRATION SURVEY REPORT NO. 240- 23

13-15 March 1962

by  
H. KURITZKY and O. RITTER

APPROVAL INFORMATION

Authority: D.S. 5431

Reference: (a) Mat. Lab. memo. of 29 Apr 1958 to Code 212,  
DDE818 Vibration Survey of 15-16 Apr 1958

Prepared by

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3/23/62

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1. Brief Summary:

An underway vibration survey was conducted on the main turbines, reduction gears, shafting and propellers during the pre-repair sea trial of the USS CONE (DD866). The ship embarked from the Charleston Naval Shipyard at 0900 on 13 Mar 1962 and arrived at the New York Naval Shipyard at 1200 on 15 Mar 1962.

The results indicated that there were no excessive vibrations in the areas inspected.

2. Personnel Contacted:

LT Burns  
LT (JG) Mauro

-Eng. Off., USS CONE (DD866)  
-Ship Supt., NavShipyard, NYK.

3. Details of Survey:

a. Draft: Fwd, 12' 6"; Mean, 13'; Aft, 13' 6"  
Displacement: 3030 tons

b. Data in the main propulsion machinery rooms was taken with an Askania hand vibrograph with a 20:1 magnification probe. Data was recorded at all bearings, in the three principal directions, while at 80% full power (316srpm). The hull survey was conducted at the base of the main gun director (02 level, fr 74). Athwartship vibrations were recorded at 10 rpm intervals in the speed range of 125 to 335srpm, with 5srpm intervals thru the critical ranges (approx. 235 and 310srpm). The instrument used to record the athwartship hull vibrations was an Askania Universal vibrograph set for 20:1 magnification.

c. Each propulsion unit consists of an H.P. and L.P. turbine flexibly connected to double reduction articulated gears. The cruising turbine is connected to the H.P. turbine by means of a single reduction gear and pinion.



4. Results:

a. From the standpoint of vibration, the analysis of the main propulsion machinery data, indicates satisfactory condition of the main turbines and reduction gears. Maximum amplitude of vibration was found to be + 5.7 mils @ 5.3 cps (prop. blade frequency). This was recorded at the forward end of the L.P. turbine in MMR #2 in the athwartship direction. This value is well below the accepted maximum. See page 4 for recorded data.

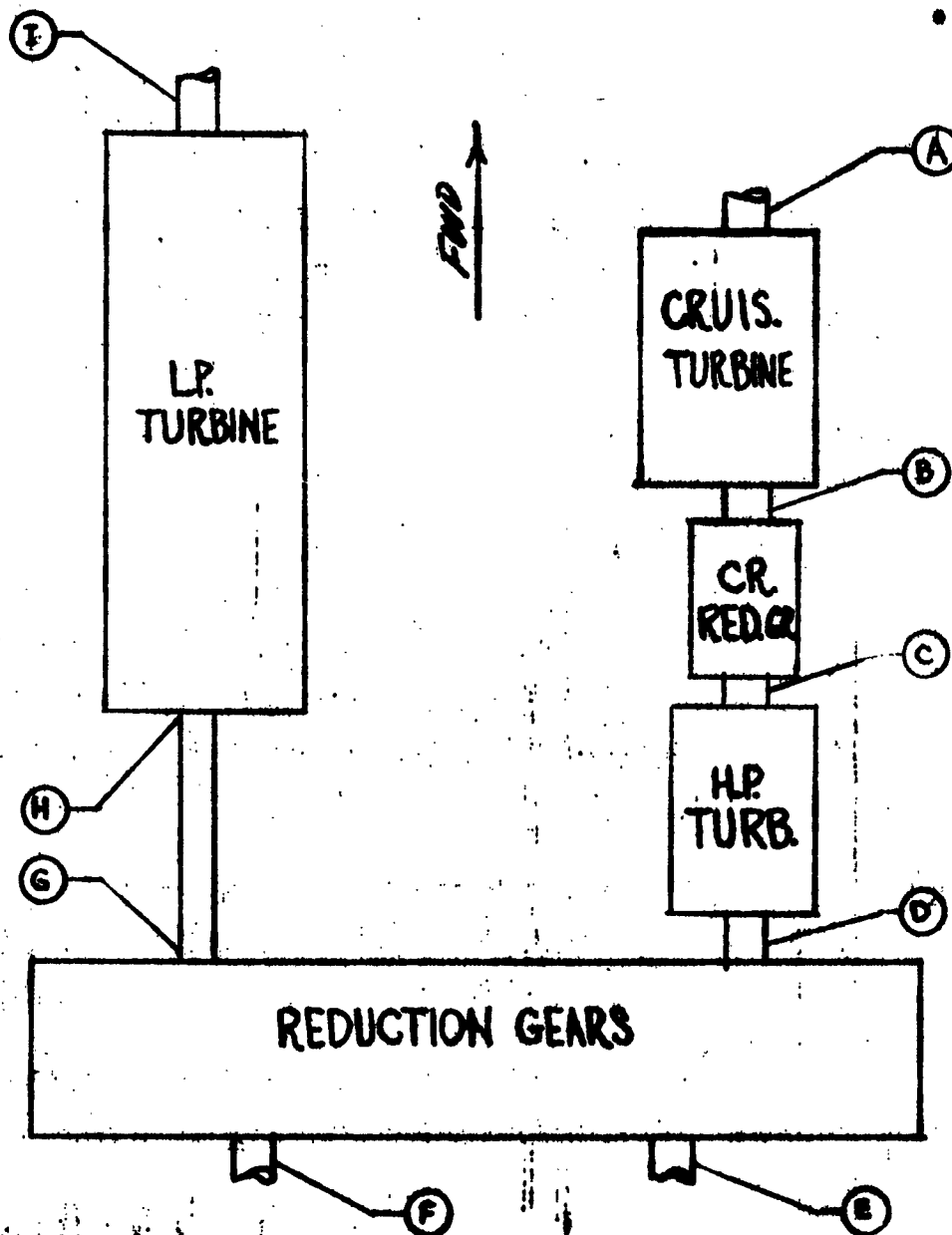
b. From the standpoint of vibration, the analysis of the hull data also indicates a satisfactory condition of the main propulsion shafting and propellers. The maximum amplitude of vibration recorded was + 2.1 mils @ 325srpm. Accepted maximum for this class ship as per reference (a), is ±20 mils. See page 5 for recorded data.

5. Conclusions and Recommendations:

From the standpoint of vibration, no work is necessary on the main turbines, reduction gears, shafting or propellers.

6. Advance information was given to Code 232 on 16 Mar 1962.

DATA STATIONS  
MAIN MACHINERY ROOM NO 1 (NO.2 OPE)  
U.S.S. CONE (DD866)  
(DIAGRAMMATIC)



USS COME (DD866)

VIBRATION DATA

MAIN MACHINERY RM NO. 1  
(FWD)

STA.	DIRECTION, ± S.A. MILS			CPS	RPM	REMARKS
	VERT.	ATHW.	FORE&AFT			
A	1.60	NEGL.	1.0	21	1260	PROP. BLADE FREQ.
B	1.75	1.0	0.4			
C	NEGL.	NEGL.	1.0			
D		↓	NEGL.			
E		0.75	0.75			
F		↓	NEGL.			
G		NEGL.	0.75			
H			NEGL.			
I		↓	1.0	↓	↓	↓

MAIN MACHINERY RM NO. 2  
(AFT)

STA.	DIRECTION, ± S.A. MILS			CPS	RPM	REMARKS
	VERT.	ATHW.	FORE&AFT			
A	3.0	5.0	1.9	21	1260	PROP. BLADE FREQ.
B	2.5	1.9	2.0			
C	4.0	1.1	NEGL.			
D	NEGL.	NEGL.	↓			
E	1.0	0.7	1.5			
F	1.8	2.0	2.0			
G	NEGL.	NEGL.	1.5			
H	0.8	0.5	0.8			
I	0.8	5.7	2.2	↓	↓	↓

# **USS CONE (DD866)** **HULL VIBRATION DATA, AFTHAWTSHIPS DIRECTION**

SHAFT RPM	CPS	± S.A. MILS	REMARKS
125	9.0	0.18	PROP. SHAFT FREQUENCY
130	9.0	0.25	
140	10.0	0.38	
150	10.0	0.44	
160	11.0	0.63	
170	12.5	0.50	
180	12.5	0.28	
190	13.0	0.38	
200	NEG.	NEG.	_____
210	NEG.	NEG.	_____
220	NEG.	NEG.	_____
225	3.75	0.63	SHAFT FREQUENCY
230	3.83	0.75	
240	4.00	1.25	
245	4.08	1.25	
250	4.17	0.80	
260	4.33	0.50	
270	4.50	0.40	
280	4.67	0.44	
285	4.75	0.60	
290	4.83	0.80	
295	4.92	0.83	
300	5.00	0.80	
305	5.09	1.00	
310	5.17	1.25	
315	5.25	1.00	
320	5.33	1.25	
325	5.42	2.10	
330	5.50	1.44	
345	5.91	1.00	

UNDERWAY VIBRATION SURVEY  
HULL AND MAIN PROPULSION MACHINERY  
USS ELLISON (DD864)

VIBRATION SURVEY REPORT 240 - 24  
26, 27, 28 Feb 1962

by

A. ALGAZE and O. RITTER

APPROVAL INFORMATION

Authority: J.O. 13-576-8001-99

D. S. 5322

Prepared by	checked by	Approved by	Date
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O. Ritter <u>OKR</u>			

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### 1. Brief Summary

A dockside vibration and noise survey was conducted on the No. 3, 600 kw ships service turbine-generator set. Analysis of the vibration data, which was taken at operating speed (1200 RPM), indicates no excessive vibration. (See Sketch 1 on Page 3) Yet, readings taken at 540 RPM reveal excessive vibratory displacement amplitudes at both turbine bearings. (Station A & B on Sketch 1) Sound level readings taken in this space also indicate a higher than allowable decibel level.

### 2. Personnel Contacted

Mr. Luchart - Code 232

### 3. Details of Survey

a. The No. 3-600kw turbine-generator set consists of a steam turbine driving the generator through a 8.3 to 1 single reduction gear. The speed is controlled by the speed governor, mounted at the top end of the oil pump drive shaft, which is driven from an extension of the low speed reduction gear by means of a worm gear drive.

#### b. Nameplate Data

- (1) Turbine Mfg.-General Electric - 6 Stage, 10022 RPM rated at 585 psi inlet steam at 855°F.
- (2) Generator Mfg.-General Electric - 6 Pole 600kw, 1200 RPM 450 volts.

c. Vibration data was recorded on the No. 3 - 600kw turbine-generator set at all bearings and foundation locations as shown on Page 3, Sketch 1, utilizing an Askania Hand Vibrograph with a 20:1 feeler tube. Readings were taken with T-G set operating at 1200 RPM (Rated RPM) at both load and no load conditions. Vibratory displacements were recorded in the three principal planes whenever possible. The measurable vibrations indicated a safe operating condition at this speed. It was noted by Ships Force that large amplitudes of vibration existed at a speed of approximately 600 RPM. When the speed of the unit, under no load conditions was stabilized at 540 RPM, readings were taken, and the results collected revealed excessive vibratory displacements at both turbine bearings. This measured vibration of  $\pm 6.75$  Mils @ 4450 CPM (turbine frequency) in the vertical direction

well exceeds the allowable  $\pm 1.2$  Mils at this frequency.

d. A noise survey was taken simultaneously with the vibration survey. All sound levels and associated Band Widths were detected utilizing a General Radio sound level meter and matched octave band noise analyzer. Sound level readings were recorded with the ship's ventilation operating and with the No. 3 T-G set operating at load and no load conditions. During load condition of No. 3 unit, the No. 1 unit, was operating under no load. (Corresponding to Condition A on Page 4.) The situation was reversed for Condition B, Page 4. Data indicated an unsatisfactory condition in this space in the 1200-2400 and 2400-4800 Band widths. During the entire sound survey No. 2 unit was inoperative.

#### 4. Results

a. From the standpoint of vibration the value of  $\pm 6.75$  Mils @ 4450 CPM is beyond the allowable limit at this frequency.

b. From the standpoint of sound level, we have an adverse operating condition. The 97.5 decibel level in the 1200-2400 CPS band width is above the specified allowable limit.

#### 5. Conclusions and Recommendations

In order to reduce vibration amplitudes and sound levels the following is recommended:

a. Dynamically rebalance, turbine and generator shafts with respective pinion and gear attached.

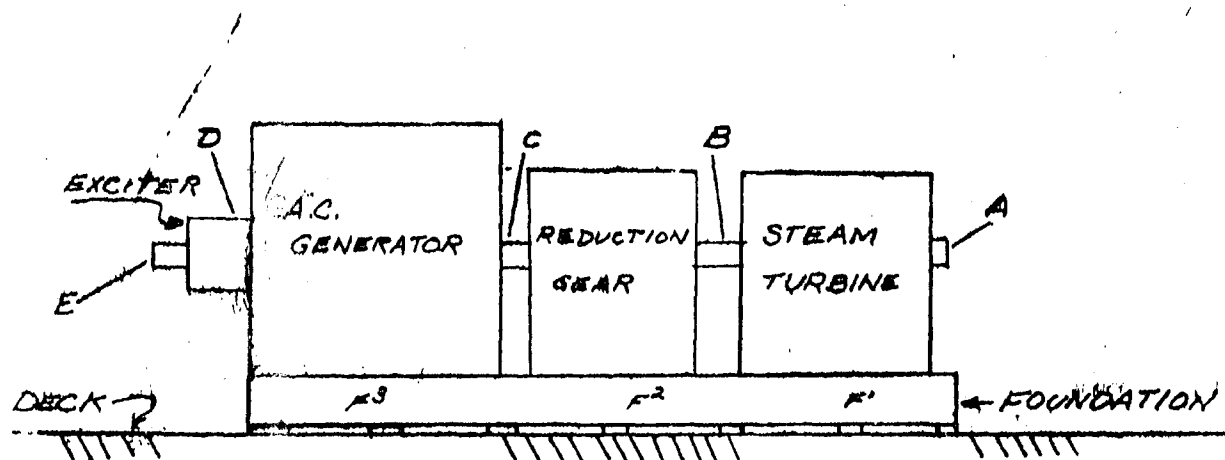
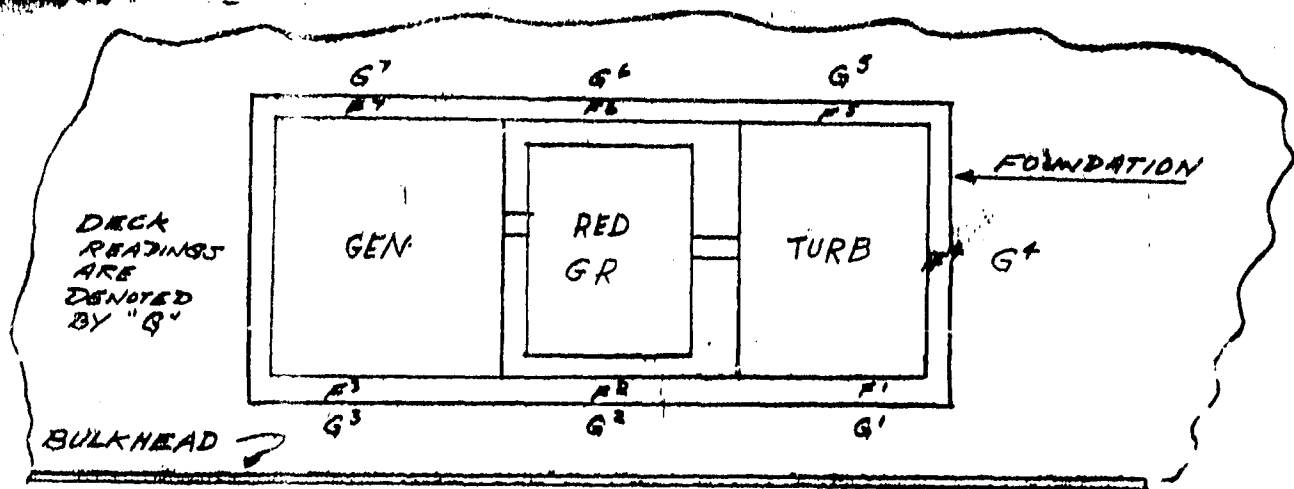
b. Check turbine shaft alignment.

c. Check turbine rotor for loose blading.

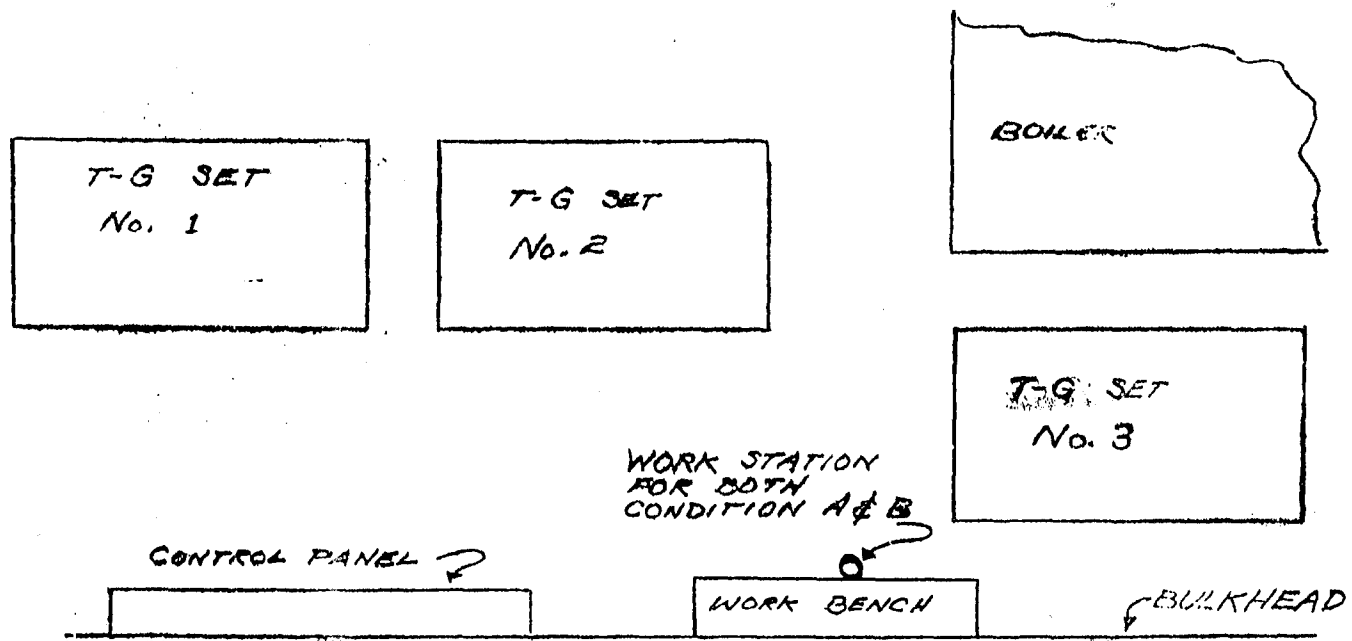
d. Check both pinion and gear for proper tooth contact and excessive wear.

6. Advance information was given to Codes 213A and 232 on 12 March 1962.





— SKETCH 1 —



— SKETCH 2 —

# SOUND DATA

NOISE CATEGORY "D"  
GEN SPECS 51-10

	OCTAVE BAND C.P.S.							
	37.5 75	75 150	150 300	300 600	600 1200	1200 2400	2400 4800	4800 9600
ALLOWABLE LEVEL	110	105	100	90	90	85	85	85
CONDITION A	79	79	85	87	92	87	87	70
CONDITION B	79	78	87	87	87	97.5	89	78

# VIBRATION DATA

NO LOAD CONDITION

STA.	DISP. - S.A. (MILS)			CPS	RPM	REMARKS
	VERT.	ATH.	F&A			
A	NEGL	NEGL	NEGL		1200	
B	NEGL	NEGL			1200	
C	NEGL	NEGL			1200	
D	NEGL	NEGL			1200	
E	.625	.250	.375	20	1200	GEN. FREQ.
F <sup>1</sup>	NEGL				1200	
G <sup>1</sup>	NEGL				1200	
F <sup>2</sup>	NEGL				1200	
G <sup>2</sup>	NEGL				1200	
F <sup>3</sup>	NEGL				1200	
G <sup>3</sup>	NEGL				1200	
F <sup>4</sup>	1.5			167	1200	TURB. FREQ
G <sup>4</sup>	NEGL				1200	
F <sup>5</sup>	NEGL				1200	
G <sup>5</sup>	NEGL				1200	
F <sup>6</sup>	NEGL				1200	
G <sup>6</sup>	NEGL				1200	
F <sup>7</sup>	NEGL				1200	
G <sup>7</sup>	.375			20	1200	GEN. FREQ

# VIBRATION DATA

## LOAD CONDITION

STA.	DISP. - SA (MILS)			CPS	RPM	REMARKS
	VERT	ATH	F&A			
A	NEGL	.250	NEGL	167	1200	TURB. FREQ
B	NEGL	NEGL			1200	
C	NEGL	NEGL			1200	
D	NEGL	NEGL			1200	
E	.750	.250	.375	20	1200	GEN. FREQ
F <sup>4</sup>	.875			167	1200	TURB. FREQ
G <sup>4</sup>	NEGL				1200	
F <sup>5</sup>	NEGL				1200	
G <sup>5</sup>	NEGL				1200	
F <sup>6</sup>	NEGL				1200	
G <sup>6</sup>	NEGL				1200	
F <sup>7</sup>	NEGL				1200	
G <sup>7</sup>	.25			20	1200	GEN. FREQ
A	6.25			74	540	TURB. FREQ
B	6.25			74	540	TURB. FREQ

VIBRATION SURVEY  
BURY 3000 PSIG AIR COMPRESSOR  
NAD EARLE, N.J.

VIBRATION SURVEY REPORT NO. 240- 29  
3 April 1962

by  
A. ISAACSON & A. ALGAZE

APPROVAL INFORMATION

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(NAD Earle (ASW)

(Att. Lt. Schoenagle (5)

1. Brief Summary:

A vibration survey was conducted on the No. 3C2 forced draft blower on 9 February and on the No. 3A2 forced draft blower on 31 March 1962. Results of the surveys indicate excessive vibration amplitudes in both units.

2. Personnel Contacted:

CPO Buca - CVA42

3. Details of Survey:

The survey on Blower 3C2 was conducted enroute Bayonne, N.J. to New York Naval Shipyard with the boiler cold. The survey on 3A2 was conducted at dockside. An Askania Hand Vibrograph with a 20 to 1 feeler tube was used to take readings in the three principal planes, where possible, at the bearings (See page 3). The speed of each unit was varied by increasing the chest pressure at the turbine in stepped increments. The Tachometers mounted on the units were inoperative. The data is tabulated on page 4.

4. Results:

Analysis of the data indicates excessive first order vibratory displacement amplitudes on both units and high amplitude one half order vibration of unit No. 3A2. Maximum readings for unit No. 3A2 were  $\pm 1$  mil at 76 cps (first order) and 1.5 mils at 40 cps, 35 cps and 33 cps (1/2 order). Maximum displacement for unit No. 3C2 was  $\pm 1.25$  mils at 85 cps (first order).

5. Conclusions

The two units are considered to be vibrating excessively. It is recommended that both units be dynamically balanced and the bearings and shaft checked for proper clearance and alignment during the next availability. It is further recommended that the structure in the vicinity of the exhaust ducting of unit No. 3A2 be reinforced and any missing or damaged structure be replaced or repaired.

#### 4. RESULTS (CONT'D)

floor of the building as shown in the sketch on page 4. The foundation was visibly pounding against the floor of the building during the survey and the concrete in the area was beginning to crumble. Further more, the piping in the vicinity of the compressor and cooler was vibrating excessively.

#### 5. CONCLUSIONS AND RECOMMENDATIONS

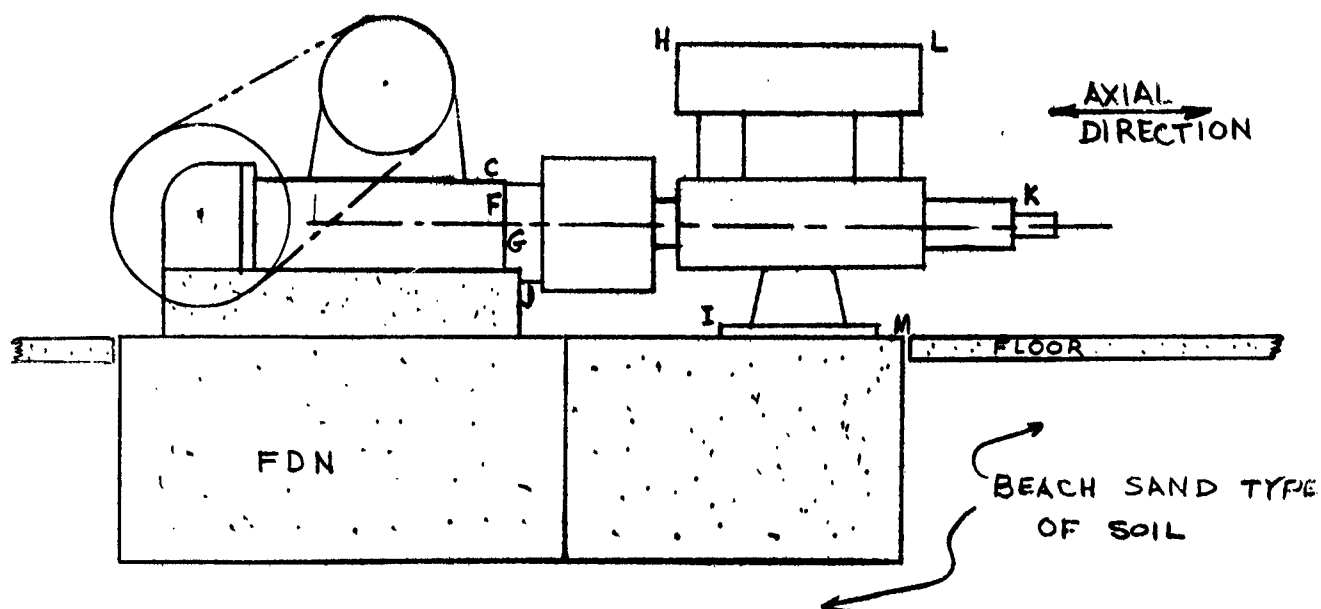
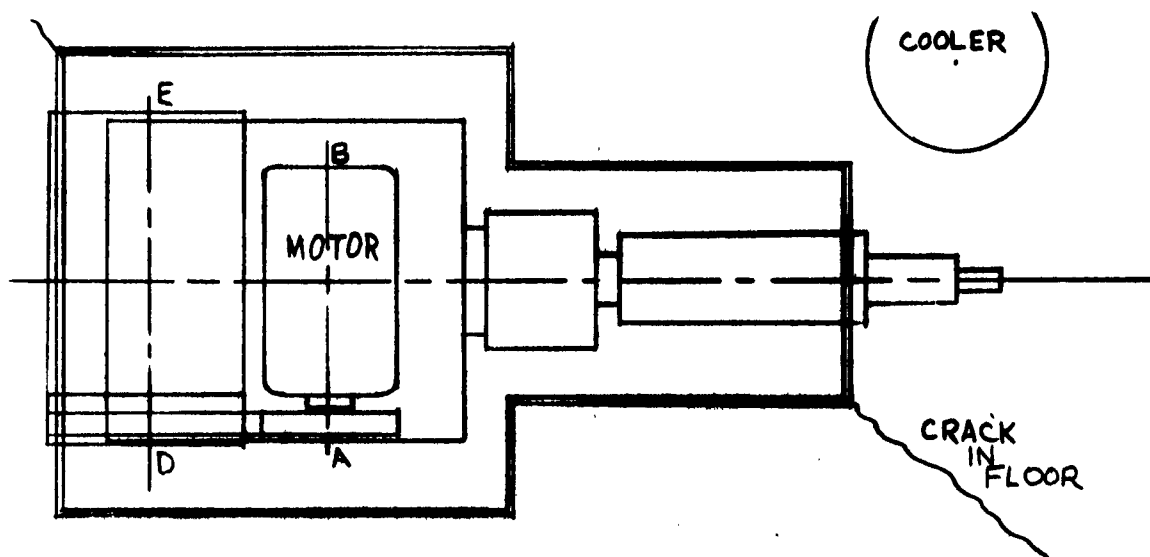
The amplitudes of vibration detected are considered to be excessive and its effect upon the environment is detrimental to continuous operation. Several possible solutions are offered in order of preference. However, the first should be instituted no matter which of the others is chosen.

A. Install flexible connections in the piping between the compressor and the building. Consider the cooler as part of the building.

B. Increase the mass of the foundation to at least 30,000 pounds in the shape of a solid rectangle rather than the present Tee shape. Isolate this foundation from a sub-foundation set in the soil with waterproof paper and vibration insulating cork (such as "vibra-cork" manufactured by Armstrong Cork Co.), the thickness to be determined from the loading and the cork manufacturers design data. See sketch "A" on page 5.

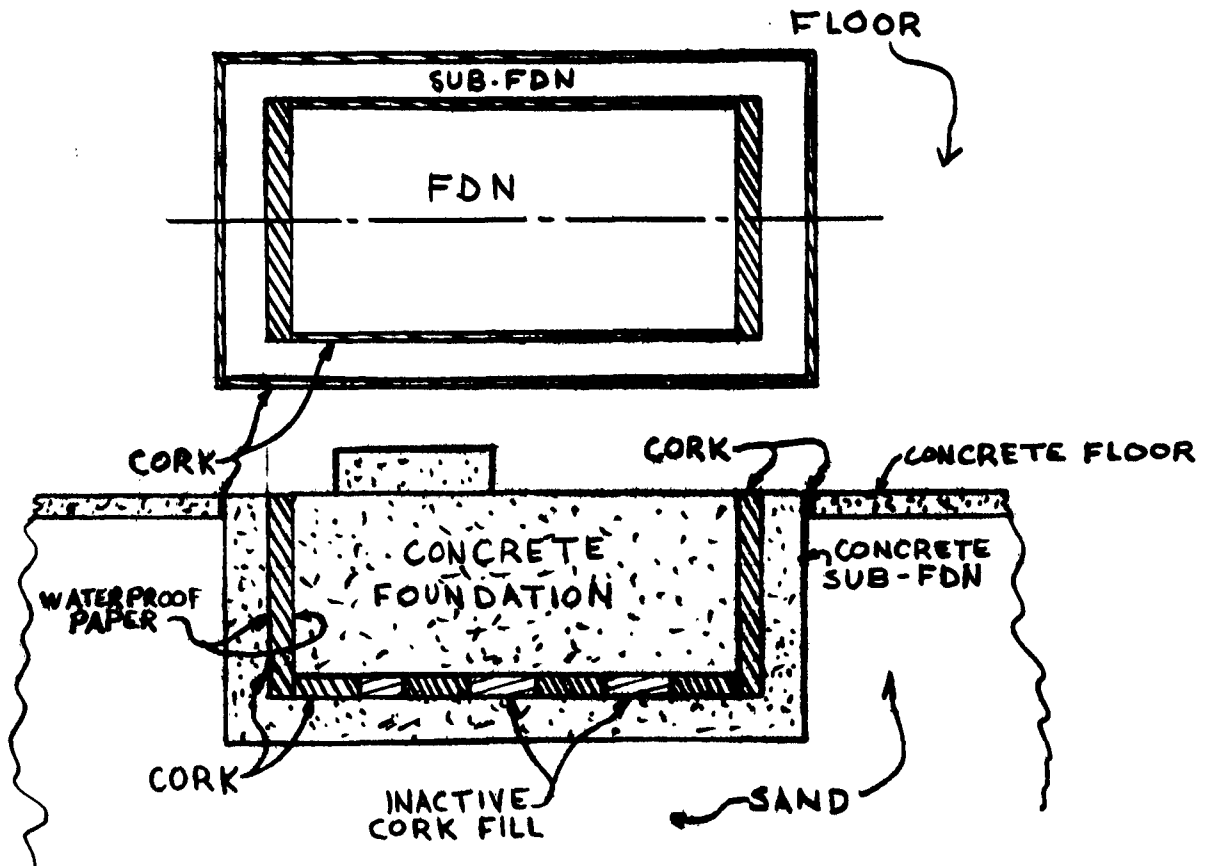
C. Increase the mass of the foundation to at least 30,000 pounds in the shape of a solid rectangle. Use vibration insulating cork between the foundation and the floor of the building. See sketch "B" on page 5.

D. Use the existing foundation. Break up the floor in the vicinity of the foundation to allow for the insertion of vibration insulating cork between the foundation and the building floor. This will not appreciably reduce the magnitude of the vibration, in the compressor, but, it will reduce the transmission of the vibration to the building and surrounding area. See sketch "C" on page 5.

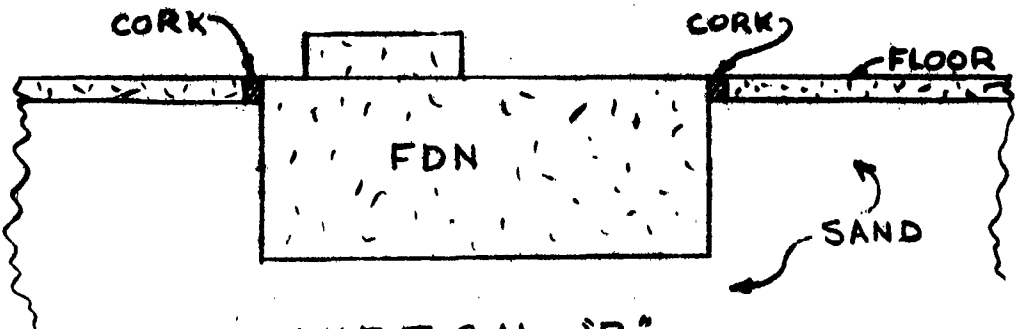


### AIR COMPRESSOR ARRGT OF VIBRATION STATIONS

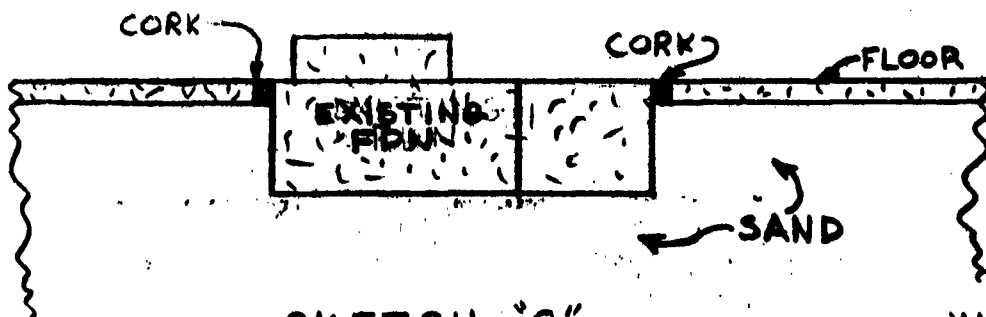
STA	DIR	AMPLITUDE	REMARKS	STA	DIR	AMPLITUDE	REMARKS
A	AXIAL	$\pm 10.5$ MILS		G	AXIAL	$\pm 2.5$ MILS	
B	AXIAL	$\pm 20$ MILS		H	AXIAL	$\pm 13$ MILS	
C	AXIAL	$\pm 8.8$ MILS		I	AXIAL	$\pm 4$ MILS	TRACE OF MOTOR FREQUENCY
C	VERT	$\pm 3.5$ MILS		J	AXIAL	$\pm 1.5$ MILS	
D	AXIAL	$\pm 2.5$ MILS		K	AXIAL	$\pm 6$ MILS	
E	AXIAL	$\pm 1.5$ MILS		K	VERT	$\pm 4$ MILS	
E	VERT	$\pm 1.0$ MILS		L	AXIAL	$\pm 10$ MILS	
F	AXIAL	$\pm 4.75$ MILS		L	VERT	$\pm 5.5$ MILS	
				M	VERT	$\pm 1.0$ MILS	



SKETCH "A"  
NOT TO SCALE



SKETCH "B"  
NOT TO SCALE



SKETCH "C"  
NOT TO SCALE



UNDERWAY VIBRATION SURVEY OF NO. 2

CRUISING TURBINE AND CRUISING

TURBINE REDUCTION GEAR

USS WARRINGTON (DD 843)

VIBRATION REPORT 240-27

21 MARCH 1962

by

A. ALGAZE AND J. R. PENN

APPROVAL INFORMATION

AUTHORITY: J.O. 13-244 -- 8160-99

Prepared by

Checked by

Approved by Date

A. Algaze

J.R. Penn

Ad

K. M. Schan 4/9/62

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1. BRIEF SUMMARY;

An underway vibration investigation was conducted on the No. 2 cruising turbine and cruising turbine reduction gear. Analysis of the vibration data reveals excessive vibratory amplitudes at the forward bearing of the cruising turbine at 192 and 247 shaft RPM. A knocking noise was also evident at the above mentioned speeds.

2. PERSONNEL CONTACTED

Lt. Miller                      Eng. Officer (DD 843)

3. DETAILS OF SURVEY

Vibration readings were taken on the No. 2 cruising turbine and cruising turbine reduction gear at the request of trial members. These readings were recorded at 139, 192 and 247 shaft RPM in the three principal planes utilizing an Askania Hand Vibrograph with a 20:1 Feeler Tube. Analysis of this data indicated a maximum vibratory displacement amplitude of + 2.13 mils at 69 eps (H.P. turbine frequency) which is well in excess of the allowable amplitude at this frequency. Additional vibration readings were requested by ships force at 1/3 backing (38 SRPM), 2/3 backing (85 SRPM) and full backing (150 SRPM). The data collected under backing down runs indicated a satisfactory condition of vibration at these speeds.

4. RESULTS:

Analysis of the data taken at 192 and 247 shaft RPM yielded excessive vibratory displacement amplitudes of + 1.25 mils maximum and + 2.13 mils maximum respectively, both at H.P. turbine frequency. (Refer to data sheet Page 3).

5. CONCLUSIONS AND RECOMMENDATIONS

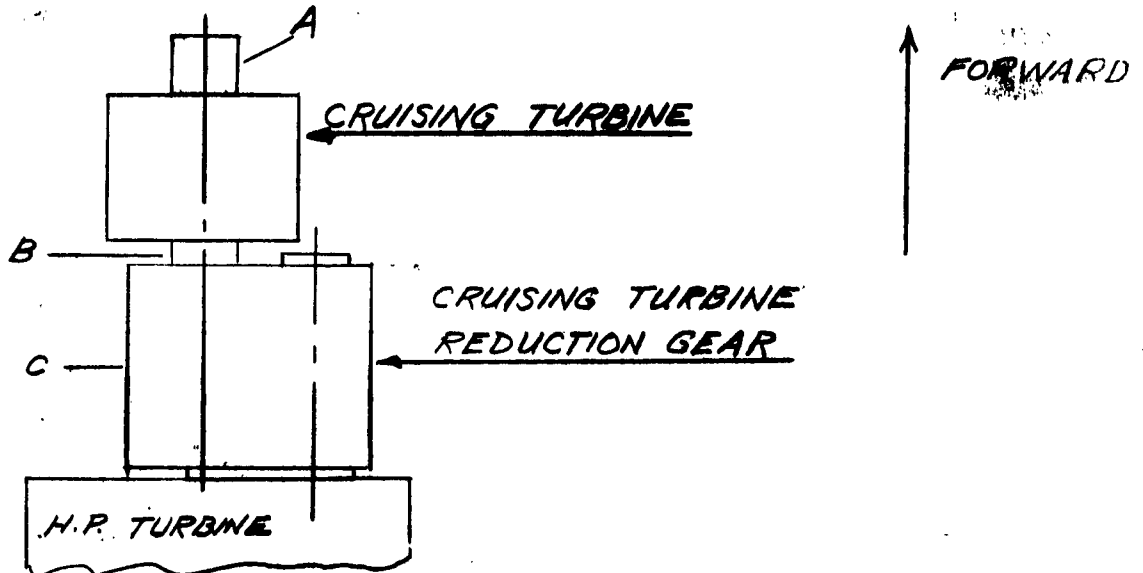
a. In order to reduce the excessive vibratory amplitudes the following is recommended:

- (1) Check H.P. Turbine, Cruising Turbine, and Cruising Turbine Reduction Gear Bearings for alignment and clearance.
- (2) Check forward foundation bolting.
- (3) Should the above (1) and (2) yield a satisfactory installation condition of alignment and bolting, dynamically balance H.P. Turbine Rotor.

b. It is also recommended that a post repair vibration survey be conducted during the first available trial.

6. Advance information was given to Code 212 on 22 March 1962.

USS WARRINGTON (DD 843)  
DATA STATIONS  
MAIN MACHINERY ROOM No. 2



VIBRATION DATA  
MAIN MACHINERY ROOM No. 2

STA.	DISP. - SA. MILS			RPS	RPM	REMARKS
	VERT.	ATH.	E&A			
A	NEGL.				38	1/3 BACKING
A	NEGL.				85	2/3 BACKING
A	NEGL.	10	10	10	150	FULL BACKING PROP FREQ
A	.125	.375	.375	39	139	H.P. TURB. FREQ.
A	.625	1.25	.125	52	192	
A	1.0	2.13	1.13	69	247	
B	NEGL.		NEGL.		139	
B	.125	NEGL.	.125	52	192	
B	.5	NEGL.	.375	69	247	
C		.125		52	192	

FORWARD SPEEDS

DOCKSIDE VIBRATION AND NOISE SURVEY  
OF NO. 1, NO. 3 AND NO. 4  
SHIPS SERVICE TURBO-GENERATOR SETS  
USS ESSEX (CVS-9)

VIBRATION SURVEY REPORT 240- 28  
28 March 1962

by  
A. ALGAZE AND O. RITTER

APPROVAL INFORMATION

Authority: J.O. 16-375-1550-99

D.A.R. 5708

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O. Ritter <u>OKR</u>		<u>Br. Head.</u> Code 264	

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1. BRIEF SUMMARY:

A dockside vibration and noise survey was conducted on the No.1, No. 3 and No. 4, Ships Service Turbo-Generator Sets (1250KW). Analysis of vibration data recorded at operating speed (3600 RPM), indicates no excessive vibration, while sound level readings taken at the No. 3 and No. 4 T-G sets indicates a higher than allowable sound level. Similar noise readings taken at the No. 1 T-G set reveals a satisfactory sound level.

2. PERSONNEL CONTACTED

W.O. Cary        CVS-9  
W.O. Luders      CVS-9

3. DETAILS OF SURVEY

a. The Turbo-Generator Sets consist of a steam turbine driving the generator through a 2.02 to 1 single reduction gear. The speed of the unit is controlled by a centrifugal type speed governor.

b. NAMEPLATE DATA

(1) Turbine Mfg. - General Electric - 7938 RPM, Throttle Steam; 525 psi and 825 °F.

(2) Generator Mfg - General Electric - 3600 RPM, 1250 KW, 2 Pole, Continuous Duty, A.C.

c. Vibration readings were taken on No.1, No.3 and No.4 Turbo-Generator Sets utilizing an Askania Hand Vibrograph equipped with a 20:1 feeler tube, while the respective units were operating at 3600 RPM and 500 KW Load. Vibratory displacement amplitudes were recorded in the three principal planes at all accessible bearings and foundation locations.

d. Noise surveys were taken simultaneously with respective vibration surveys on the No. 1, No. 3 and No. 4 Turbo-generator sets. All sound level and associated band width readings were detected utilizing a General Radio Sound Level Meter and matched Octave Band Noise Analyzer.

(See Sketch pg 4).

4. Results:

No. 1, No. 3 and No. 4 T-G Sets are all within the allowable limits of vibrations. However, units No.3 and No 4 have excessive noise in the 1200 to 2400 and 2400-4800 octave band widths. These high sound levels are detrimental to personnel standing watches near the unit, and indicate a malfunctioning of unit No.3 and No.4. Turbo-Generator Set No. 1 is operationally satisfactory.

5. Conclusions and Recommendations.

In order to reduce sound levels in the No.3 and No.4 T-G sets the following is recommended.

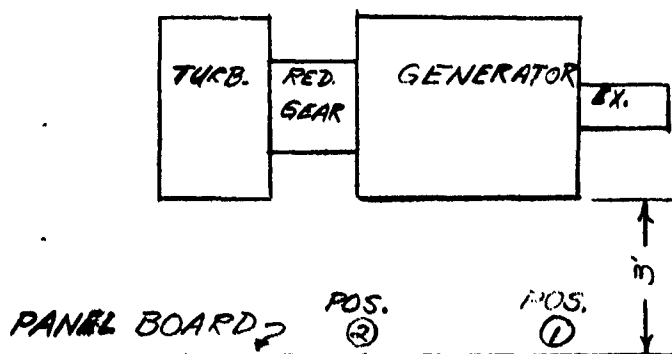
- (a) Check generator rotor alignment for proper air gap.
- (b) Check tooth contact between pinion and gear.
- (c) Check all gear bearings.

6. Advance information given to Code 211, 5 April 1962.

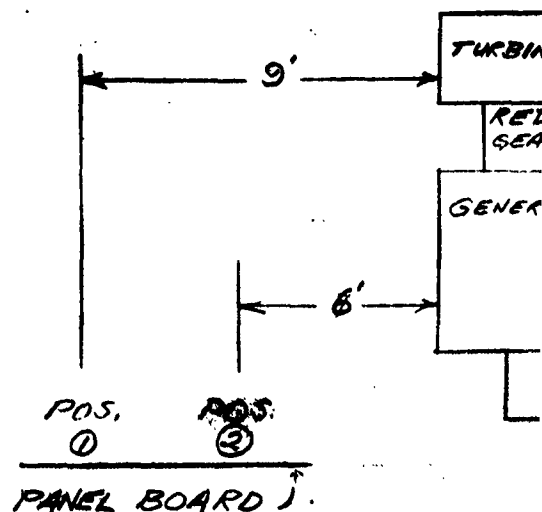
# SOUND DATA

	OCTAVE BAND C.P.S.								
	20 10 KC	37.5 75	75 150	150 300	300 600	600 1200	1200 2400	2400 4800	4800 9600
ALLOWABLE db LEVEL	—	110	105	100	90	90	85	85	85
T-G No. 1 POS. 1	92	84	89	81	80	79	84	76	73
T-G No. 1 POS. 2	92	81	92	81	78	75	78	69	66
T-G No. 3 POS. 1	103	90	94	87	94	91	99	89	81
T-G No. 3 POS. 2	106	92	98	90	89	94	102	99	85
T-G No. 4 POS. 1	103	95	92	88	87	92	101	93	82
T-G No. 4 POS. 2	109	90	102	94	91	97	107	96	84

LAYOUT OF T-G SETS 3 & 4



LAYOUT OF T-G SET 1



NOTE: ALL DIMENSIONS  
ARE APPROXIMATE

VIBRATION SURVEY  
FORCED DRAFT BLOWERS 3A2 & 3C2  
USS ROOSEVELT (CVA42)

VIBRATION SURVEY REPORT NO. 240-30  
9 FEB AND 31 MAR 1962

BY

A. SELTZER & A. ISAACSON & A. ALGAZE

APPROVAL INFORMATION

AUTHORITY: D.S. 5239 J.O. 16-380-1120

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(Code 264)

DATE

*5/4/62*

Distribution:

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	273A



1. Brief Summary:

A vibration survey was conducted on the No. 3C2 forced draft blower on 9 February and on the No. 3A2 forced draft blower on 31 March 1962. Results of the surveys indicate excessive vibration amplitudes in both units.

2. Personnel Contacted:

CPO Buca - CVA42

3. Details of Survey:

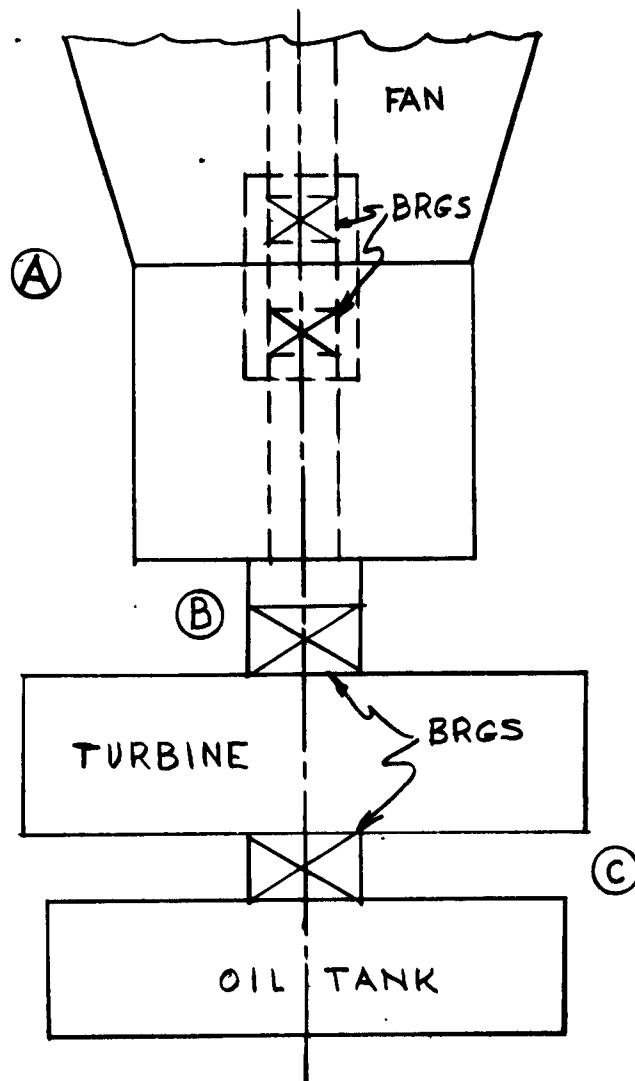
The survey on Blower 3C2 was conducted enroute Bayonne, N.J. to New York Naval Shipyard with the boiler cold. The survey on 3A2 was conducted at dockside. An Askania Hand Vibrograph with a 20 to 1 feeler tube was used to take readings in the three principal planes, where possible, at the bearings (See page 3). The speed of each unit was varied by increasing the chest pressure at the turbine in stepped increments. The Tachometers mounted on the units were inoperative. The data is tabulated on page 4.

4. Results:

Analysis of the data indicates excessive first order vibratory displacement amplitudes on both units and high amplitude one half order vibration of unit No. 3A2. Maximum readings for unit No. 3A2 were  $\pm 1$  mil at 76 cps (first order) and 1.5 mils at 40 cps, 35 cps and 33 cps (1/2 order). Maximum displacement for unit No. 3C2 was  $\pm 1.25$  mils at 85 cps (first order).

5. Conclusions

The two units are considered to be vibrating excessively. It is recommended that both units be dynamically balanced and the bearings and shaft checked for proper clearance and alignment during the next availability. It is further recommended that the structure in the vicinity of the exhaust ducting of unit No. 3A2 be reinforced and any missing or damaged structure be replaced or repaired.



VIBRATION STATIONS  
CVA 42 FORCED DRAFT BLOWERS

NAME PLATE DATA :

MFG - B.F. STURDEVANT

TYPE VX-7

MAX RPM, 6250

NORM RPM. 4750

157 HP, 575 PSI.

15 PSI. EXH. 1944

RPM.	STA.	DIR.	CPS.	AMP-MILS	ORDER
2400	C	F&A	40	$\pm .125$	FIRST
3120	A	ATH	52	$\pm .25$	FIRST
3600	C	ATH	60	$\pm .25$	FIRST
3840	C	ATH	32	$\pm .75$	$\frac{1}{2}$
3840	B	F&A	32	$\pm .25$	$\frac{1}{2}$
3840	C	F&A	32	$\pm .75$	$\frac{1}{2}$
3960	C	ATH	33	$\pm 1.0$	$\frac{1}{2}$
3960	C	F&A	33	$\pm 1.5$	$\frac{1}{2}$
3960	A	ATH	33	$\pm .25$	$\frac{1}{2}$
4200	C	F&A	35	$\pm 1.13$	$\frac{1}{2}$
4200	C	ATH	35	$\pm 1.5$	$\frac{1}{2}$
4440	C	F&A	37	$\pm 1.0$	$\frac{1}{2}$
4440	A	ATH	37	$\pm .5$	$\frac{1}{2}$
4440	A	F&A	37	$\pm .5$	$\frac{1}{2}$
4560	A	ATH	38 76	$\pm .5$ $\pm 1.0$	$\frac{1}{2}$ FIRST
4800	C	VERT	48 80	$\pm .875$ $\pm .875$	$\frac{1}{2}$ FIRST
4800	C	F&A	40	$\pm 1.0$	$\frac{1}{2}$
4800	C	ATH	40 80	$\pm .75$ $\pm .75$	$\frac{1}{2}$ FIRST
4800	A	ATH	40	$\pm 1.25$	$\frac{1}{2}$
4800	A	F&A	40	$\pm 1.5$	$\frac{1}{2}$
4800	B	ATH	40	$\pm .13$	$\frac{1}{2}$
4800	B	VERT	40	$\pm .5$	$\frac{1}{2}$

F.D. BLOWER NO. 3A2

RPM.	STA.	DIR.	CPS.	AMP-MILS	ORDER
3250	A	F&A	54	.025	FIRST
3250	C	F&A	54	.025	FIRST
3400	A	F&A	57	.5	FIRST
3600	A	F&A	60	.375	FIRST
3600	B	ATH	60	.5	FIRST
3700	A	ATH	62	.025	FIRST
3700	C	F&A	61 62	.75 .025	$\frac{1}{2}$ FIRST
3700	B	F&A	62	.025	FIRST
3900	C	F&A	65	.625	FIRST
3900	B	F&A	65	.065	FIRST
3900	A	F&A	65	.375	FIRST
4300	C	F&A	72	.75	FIRST
4300	B	F&A	72	.5	FIRST
5100	C	ATH	85	1.25	FIRST
5100	A	F&A	85	.625	FIRST
5400	C	F&A	90	1.25	FIRST
5400	B	F&A	90	1.12	FIRST
5400	A	F&A	90	1.0	FIRST
5600	B	F&A	93	.75	FIRST
5600	A	F&A	93	1.25	FIRST

F.D. BLOWER NO. 3C2

NOTE: ONLY SIGNIFICANT DATA IS SHOWN. ALL READINGS TAKEN WHICH WERE NEGLIGIBLE ARE NOT LISTED. READINGS WERE TAKEN WITH REGISTERS WIDE OPEN.

### CVA 42 VIBRATION DATA

UNDERWAY VIBRATION SURVEY  
MAIN PROPULSION MACHINERY AND HULL

U.S.S. KENNEDY DD850

VIBRATION SURVEY REPORT NO. 240-31

14 APRIL 1962

By

O. RITTER AND M. MEREND

APPROVAL INFORMATION

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5/11/62

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## 1. BRIEF SUMMARY

An underway vibration survey was conducted on the hull and the main turbines and reduction gears in both #1 and #2 main machinery rooms. Hull vibrations are a measure of shafting and propeller vibratory performance. The ship embarked from the New York Naval Shipyard at 0645 and returned 1930 on 14 April 1962. The results indicated that there were no excessive vibrations in the areas inspected. The ship was brought up to 80% full power during the survey.

## 2. PERSONNEL CONTACTED

Lt. Datamach

- Engineering Officer DD 850

## 3. DETAILS OF SURVEY

Vibration amplitudes were recorded in the three principal directions on bearings of the main propulsion turbines and on both forward and aft ends of the reduction gears. Readings were taken with an Askania Hand Vibrograph utilizing a 20:1 feeler tube at 315 shaft RPM.

Additional readings at 192 shaft RPM at the cruising and L.P. turbines in engine room #1 were requested by the ship's force. Data indicates small amplitudes of vibration at cruising and HP turbine frequencies. These two separate vibrations beat against each other and are the probably cause of the noise noted by the ship's force. No unsatisfactory conditions exist.

The main propulsion shafting and propeller survey was conducted utilizing a Universal Askania Vibrograph, set for 20:1 magnification. Data was recorded in the athwartship direction at the base of the main gun dca (02 Level-Frame 74). This location is considered to be a reference point for this class of ship (DD710 Class). Readings were taken at 10 RPM intervals in the speed range of 160 to 320 shaft RPM with 5 RPM intervals through the critical ranges.

## 4. RESULTS

The data collected indicates no excessive vibration of the main propulsion plant at 80% full power, 315 shaft RPM. This was the maximum speed obtained during the survey. The maximum singular vibratory displacement amplitudes were  $\pm 1$  mil @ 91 cps recorded at the forward end of the #2 cruising turbine in the fore and aft direction, and  $\pm 2.7$  mils @ 22 CPS. (prop. blade frequency) recorded at the forward end of the #2 HP turbine in the vertical direction.

#### 4. RESULTS (Continued)

Analysis of the hull data indicates satisfactory condition of the propulsion shafting and propellers from the standpoint of vibration. The maximum singular vibratory displacement amplitude recorded was  $\pm 8$  mils at 310 shaft RPM in the athwartship direction.

#### 5. CONCLUSIONS

From the standpoint of vibration, the hull, main turbines, reduction gears, shafting and propellers are satisfactory.

UNDERWAY VIBRATION SURVEY ON  
MAIN PROPULSION MACHINERY AND HULL  
USS ROAN DD853

VIBRATION SURVEY REPORT 240-32  
8-9 May 1962

by

O. RITTER and M. MEREND

APPROVAL INFORMATION

Authority: J.O. 13-244-8160-99

Prepared by	Checked by	Approved by	Date
O. Ritter <u>OKR</u>	<u>A. Lunsom</u>	<u>R. M. Schan</u>	<u>25 May</u>
M. Merend <u>Ma</u>		<u>W. J.</u>	

DISTRIBUTION:

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264B

1. Brief Summary:

An underway vibration survey was conducted on the hull and the main turbines and reduction gears in both #1 and #2 main machinery rooms. Hull vibrations are a measure of shafting and propeller vibratory performance. The ship embarked from the New York Naval Shipyard at 0630 on 8 May 1962 and returned at 1630 on 9 May 1962. The results indicated that there were no excessive vibrations in the areas inspected.

2. Personnel Contacted:

LT Comey

-Engineering Officer DD853

3. Details of Survey:

Vibration amplitudes were recorded in the three principal directions on bearings of the main propulsion turbines and on both forward and aft ends of the reduction gears. Readings were taken with an Askania Hand Vibrograph utilizing a 20:1 feeler tube at 315 shaft RPM.

The main propulsion shafting and propeller survey was conducted utilizing a Universal Askania Vibrograph, set for 20:1 magnification. Data was recorded in the athwartship direction at the base of the main gun director foundation (02 level - frame 74). This location is considered to be the reference point for this class of ship (DD 710 class). Readings were taken approximately at 10 RPM intervals in the speed range 140 to 330 SRPM with 5 RPM intervals through the critical ranges.

4. Results:

The data collected indicates no excessive vibration at the main propulsion plant at 80% full power, (315 SRPM). This was the maximum speed obtained during the propulsion plant survey. The maximum singular vibratory displacement amplitudes were + 1 mil @ 84 cps recorded at the forward end (N.P.T) of the #2 cruising turbine in the athwartships direction and +6.5 mils @ 22 cps (prop. blade frequency) recorded at the forward end of the #2 HP turbine in the vertical direction.



4. Results:(cont'd)

Analysis of the hull data indicates satisfactory condition of the propulsion shafting and propellers from the standpoint of vibration. The maximum singular vibratory displacement amplitude recorded was + 12 mils at 310 shaft RPM.

5. Conclusions and Recommendations:

From the standpoint of vibration the hull, main turbines, reduction gears, shafting and propellers are satisfactory. To prevent vibration problems in the future it is recommended that the casing, coupling covers and foundation bolts in the area of the #2 cruising turbine reduction gear be checked for tightness.

6. Advanced information was given to Code 212 on 11 May 1962.

UNDERWAY VIBRATION SURVEYS  
HULL AND MAIN MACHINERY  
USS WARRINGTON (DD843)

30, 31 March 1962

9, 10 April 1962

19 April 1962

25, 26 April 1962

VIBRATION REPORT NO. 240-33  
BY

A. ALGAZE

M. MEREND

A. ISAACSON

O. RITTER

APPROVAL INFORMATION

Authority: J.O. 13-244-8160-99

Prepared by

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Approved by

Date

M. Merend hm

A. Isaacson

R. M. Schan 25 May 62

O. Ritter CKR

Distribution:

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## 1. Brief Summary

Underway vibration surveys were conducted on USS WARRINGTON (DD843) on 30, 31 March; 9, 10 April; 19 April; and 25, 26 April. The data indicates excessive vibration at the forward end of the #1 cruising turbine at high pressure turbine frequency. It is recommended that the high pressure turbine rotor be balanced and aligned at the next availability.

## 2. Brief History

a. On 14 April 1961, enroute Newport, Rhode Island to Brooklyn, New York, a pre-FRAM vibration survey was conducted on the USS WARRINGTON (DD843). The results of the survey indicated a satisfactory condition of propellers, shafting, reduction gears, HP, LP, and cruising turbines. However, excessive fourth order vibration, with respect to the shaft (21 CPS), was experienced at the forward end of the cruising and LP turbines in machinery room #2. The following recommendations were made:

(1) Accomplish ShipAlt DD710-1152, "Replace turbine's turbine support flexing plate bolts".

(2) Inspect flexing plate assembly for distortion or damage.

(3) Inspect turbine mounting bolts for tightness or failure. In a like manner inspect cruising turbine mount bolts.

b. The following work was then accomplished during the availability.

(1) The above recommendations were accomplished.

(2) Rotors were taken out and dynamically balanced, 12th stage modified, and additional bladings were modified.

(3) Clearances were checked and the rotor aligned

2. Brief History (Cont'd)

c. On the 21 March 1962 during Builders Trials, vibration readings were taken on the #2 machinery plant at various speeds. Excessive vibration was found at the forward end of the cruising turbine at high pressure turbine frequency. Readings were not taken in machinery room #1 due to a leak in the horizontal joint of the H.P. turbine.

It was recommended that the high pressure turbine, cruising turbine, and cruising turbine reduction gear bearings be checked for alignment and clearances, and a check of forward foundation bolting be made. Should these checks yield a satisfactory installation of the components, the high pressure turbine rotor should be balanced.

d. The following work was accomplished after the Builder's Trials.

(1) The No. 1 high pressure turbine casing was lifted, the leak corrected, clearances checked and the casing replaced

(2) The No. 2 high pressure turbine casing was lifted, clearances checked, and the casing replaced.

e. The following is a report on the trials held between 30 March 1962 and 26 April 1962.

3. Personnel Contacted:

Lt. Miller

Eng. Officer (DD843)

4. Details of Surveys.

a. The main propulsion shafting and propeller vibration survey was conducted using a universal Askania Vibrograph set for 20:1 magnification. Data was recorded in the athwartships direction at the base of the gun director frame 74 - 02 Level. This is considered to be a reference point for this class ship (DD710 class). Recordings were taken at 10 RPM intervals in the speed range of 140-315 shaft RPM with 5 RPM intervals through the critical ranges. (Approx. 235 shaft RPM and 310 shaft RPM).

4. Details of Surveys (Cont'd)

b. The main propulsion turbines and reduction gears vibration surveys were conducted utilizing an Askania Hand Vibrograph with a 20:1 feeler tube. Data was recorded at all bearings in the three principal directions. Results are tabulated on pages (6-11).

5. Results of Surveys.

a. On 30, 31 March a hull and main propulsion survey was conducted, while the ship was running at 80% full power (315 shaft RPM).

(1) Analysis of the hull data indicates a satisfactory condition of the main propulsion shafting and propellers from the standpoint of vibration. The maximum singular vibratory displacement amplitude recorded was  $\pm 5$  Mils at 305 shaft RPM.

(2) Analysis of machinery room #1 data indicates large amplitudes of vibration at the forward end of the cruising turbine in the fore and aft direction. The maximum singular vibratory displacement amplitude was  $\pm 1$  Mils at 83 cps (high pressure turbine frequency).

(3) Analysis of machinery room #2 data indicates large amplitudes of vibration at the forward end of the high pressure turbine in the vertical direction, and at the forward end of the low pressure turbine in the athwart ships direction. The maximum singular vibratory displacement amplitude at these points was 11 mils at 22 cps fourth order with respect to the shaft). These are propeller blade induced vibrations which are transmitted and amplified by the hull and foundation.

b. The following recommendations were made.

(1) Hull - no work necessary

(2) Machinery room #1 - it is recommended that the cruising turbine and the high pressure turbine be observed for an increase in vibration and an additional survey be conducted on main propulsion plant #1.

(3) Machinery room #2 - check bolts of the foundation and covers for tightness in the area of the low and high pressure turbines.

c. The following work was accomplished:

- (1) A new flexible coupling was installed between the #2 high pressure turbine and the #2 cruising turbine.
- (2) The #1 high pressure turbine casing was lifted, a leak in the horizontal joint fixed and the casing replaced.

d. On 9, 10 April 1962, the ship went out on P.A.T. A vibration team was not on board therefore no vibration survey was taken.

- (1) The #1 H.P. turbine vibrated at 20 knots to the extent that the ship force and INSURV felt the vibration to be excessive and limited the speed of the shaft to well below 20 knots.

- (2) The number two shaft wiped a bearing and was locked.

e. The following work was accomplished after this trial:

- (1) A new flexible coupling was installed between the #1 h.p. turbine and the #1 cruising turbine.

- (2) The #1 h.p. turbine casing was lifted. A piece of asbestos was found caught between the rotor and the turbine casing. The rotor was lifted, clearances checked, and the rotor and casing replaced.

- (3) The strut bearing was replaced on the #2 shaft.

f. On 19 April 1962 a main propulsion plant survey was conducted at various speeds (15, 20, 25, 30 knots, and full power).

- (1) Analysis of machinery room #1 data taken during the full power run indicates excessive vibration at the forward end of the cruising turbine in the athwartships direction. The maximum singular vibratory displacement amplitude at this point was  $\pm 2.75$  mils at high pressure turbine frequency (94 cps).

- (2) Analysis of machinery room #2 data taken during 80% full power indicates a satisfactory condition of main turbines and reduction gears with respect to vibration. The maximum singular vibratory displacement amplitude was  $\pm 6$  mils at 21 cps at the forward end of the low pressure turbine (propeller blade frequency.)

**g. The following recommendations were made:**

- (1) The foundation bolts of the #1 high pressure and the #1 cruising turbine be checked for tightness.
- (2) #2 propulsion plant - no work necessary.
- (3) An additional survey be taken on the #1 h.p. turbine and the #1 cruising turbine during the next trial.

**h. The following work was accomplished:**

- (1) The foundation bolting was checked for tightness and loose bolts tightened.
- i. On 25, 26 April 1962, the ship went out on a second P.A.T. Readings were taken at 80% full power.**
- (1) Analysis of machinery room #1 data indicates excessive vibration at the forward end of the cruising turbine in the athwartships direction. The maximum singular vibratory displacement amplitude at this point was  $\pm 2.1$  mils at high pressure turbine frequency. (84 cps).
  - (2) Analysis of machinery room #2 data reveals a satisfactory condition.

**6. Final Conclusions and Recommendations.**

- (1) Hull - no work necessary.

(2) The excessive vibration (2.1 mils @ 84 cps) at the forward end of the cruising turbine is being induced by the high pressure turbine. It is recommended that at the next availability the high pressure turbine rotor be taken out and dynamically balanced, and realigned when replaced.

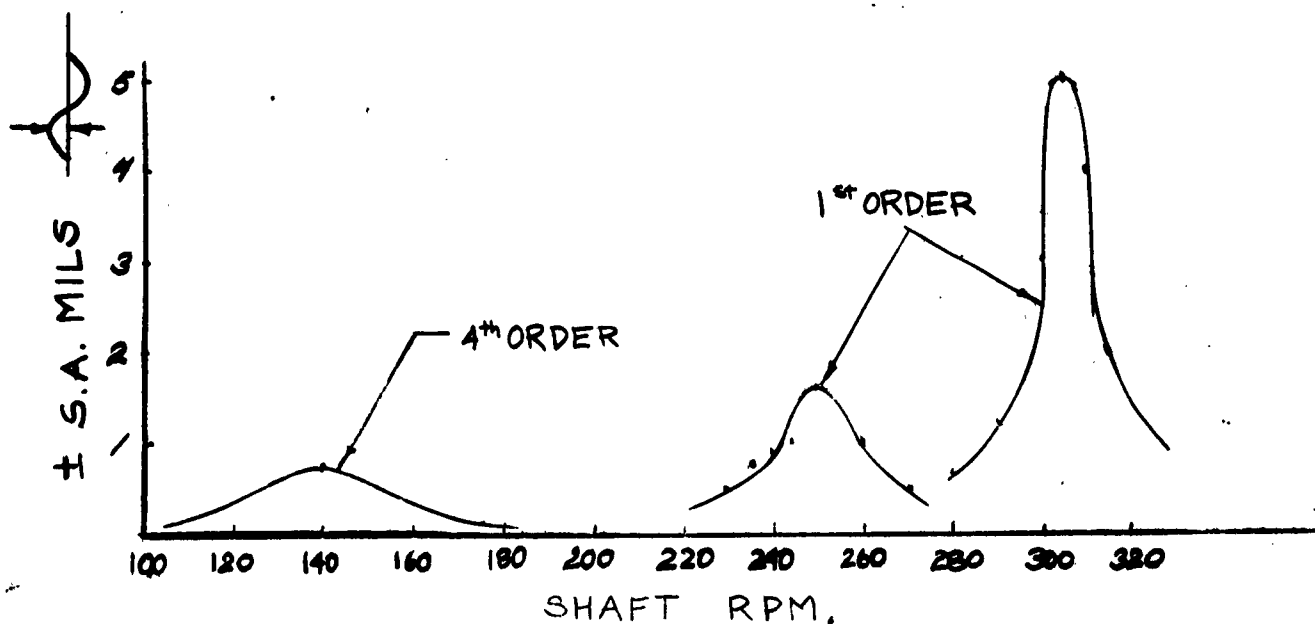


USS WARRINGTON (DD843)  
HULL VIBRATION DATA  
ATHWARTSHIP DIRECTION

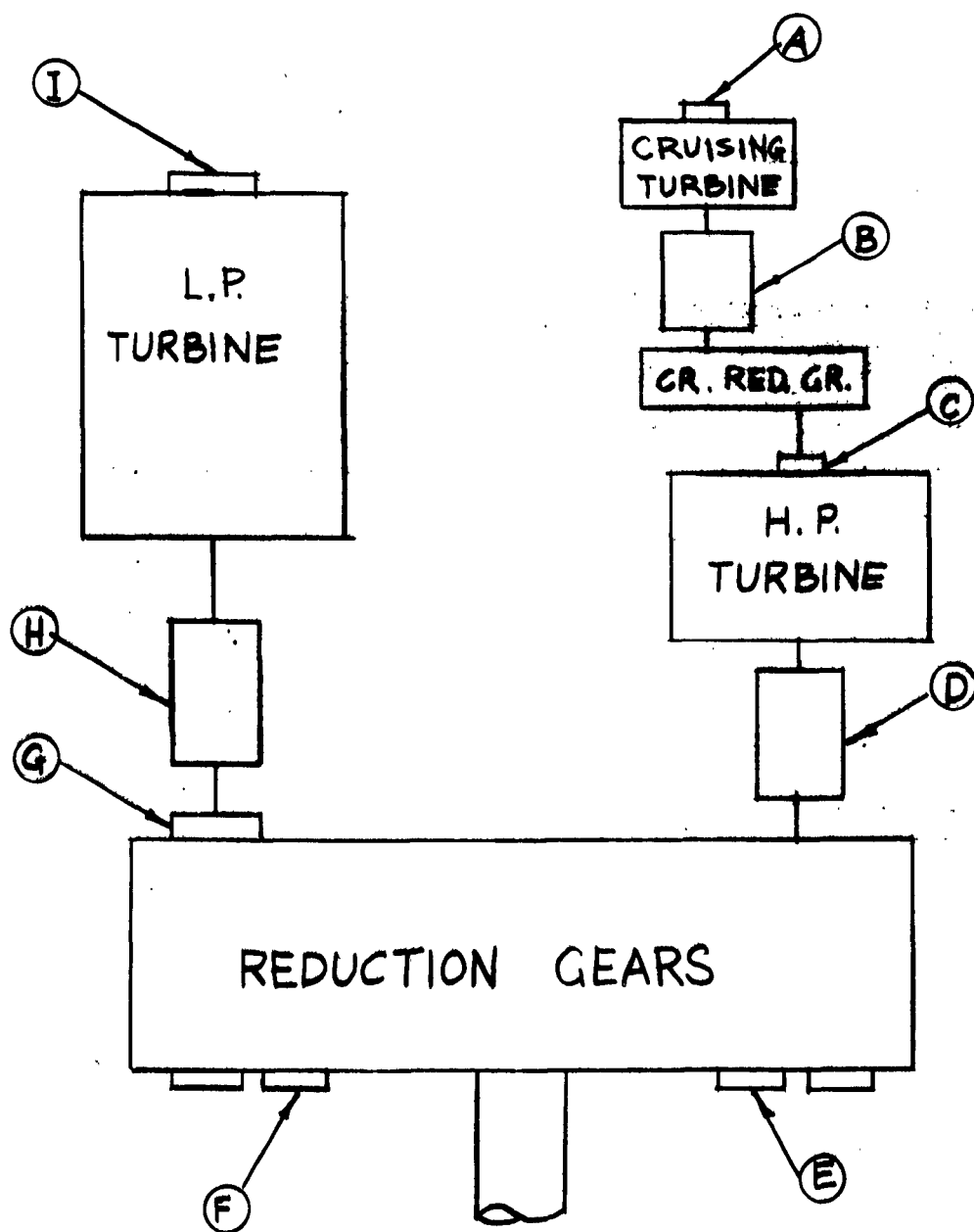
30, 31 March 1962

SHAFT R.P.M.	CPS	+ S.A. Mils	REMARKS	Shaft RPM	CPS	+ S.A. Mils	REMARKS
140	9.3	neg.	Prop. Freq.	230	3.8	.5	Shaft Freq.
150	10	.75	"	235	3.9	.75	"
160	10.7	neg.	"	240	4.	.9	"
170	11.3	neg.	"	245	4.1	1	"
180	12.0	neg.	"	250	4.2	1.7	"
190	12.6	neg.	"	260	4.3	1.	"
200	13.3	neg.	"	270	4.5	.5	"
210	14.0	neg.	"	280	4.7	.7	"
220	14.7	neg.	"	290	4.8	1.2	"
				300	5	3	"
				305	5.1	5	"
				310	5.2	4	"
				315	5.3	2	"

DISPLACEMENT IN MILS VS. SHAFT RPM



# USS WARRINGTON DD843 DATA STATIONS



VIBRATION DATA  
30, 31 March 1962

MACHINERY RM #1

STA	Direction $\pm$ SA Mills			CPS	Shaft RPM	Remarks
	Vertical	Athwart	Fore & Aft			
A	.3	.7	1.0	84	315	H.P.Turb. Frequency
B	negl	.5	negl	84	315	H.P.Turb. Frequency 2nd order shaft
	1.25	1.5	1.25	11		
C	1.0	negl	negl	11	315	2nd order shaft
D	negl	.4	.25	84	315	H.P. Turb. Frequency
E	.6	negl	2	11	315	2nd order shaft
F	negl	negl	negl	-	315	- -
G	Trace	.3	negl	84	315	H.P. Turb. Frequency 2nd Order shaft
	negl	1	1	11		
H	1	.75	negl	11	315	2nd Order shaft
I	negl	negl	negl	-	315	- -

MACHINERY RM #2

STA	Direction $\pm$ SA Mills			CPS	SHAFT RPM	Remarks
	Vertical	Athwart	Fore & Aft			
A	negl	.5	negl	84	315	H.P.Turb. Freq. Prop.blade Freq.
	1.2	2	1.7	22		
B	5.5	trace	1	22	315	Prop.blade Freq.
C	11	trace	Trace	22	315	Prop.blade Freq.
D	negl	negl	negl	-	315	- -
E	negl	4	3.5	22	315	Prop.blade Freq.
F	1.3	1.3	4.5	22	315	Prop.blade Freq.
G	negl	1	2	22	315	Prop.blade Freq.
H	1	negl	4	22	315	Prop.blade Freq.
I	1	11	3	22	315	Prop.blade Freq.

**VIBRATION DATA**  
14 April 1962

**Machinery Room #1**

STA	Direction $\pm$ SA Mils			CPS	Shaft RPM	Remarks
	Vertical	Athwart	Fore & Aft			
A	negl	.25	negl	51	190	H.P.Turb.Freq.
	negl	1.0	0.5	12		prop.blade freq.
B	.65	negl	negl	12	190	prop blade freq.
C	.65	1.0	negl	12	190	prop.blade freq.
D	-	negl	-	-	190	-
A	.12	1.1	.12	84	315	H.P.Turb. freq.
	negl	4	negl	22		prop blade freq.
B	.12	.12	negl	22	315	prop blade freq.
C	2.8	.75	-	22	315	prop blade freq.
	negl	.12	-	84		H.P.Turb.freq.
D	negl	.75	.63	84	315	H.P.Turb.freq.
	.75	1.25	negl	22		prop blade freq.
E	Trace	Trace	Trace	84	315	H.P Turb.Freq.
F	Trace	Trace	Trace	22	315	prop blade freq.
G	Trace	Trace	Trace	22	315	prop blade freq.
I	-	1.5	-	22	315	prop blade freq.

**Full Power**

STA.	Athwart.	CPS	Remarks
A Fwd	2.75	94	H.P.Turb.Freq.
A Mid	2.0	94	H.P.Turb.Freq.
A Aft	1.25	94	H.P.Turb.Freq.
B Fwd	.75	94	H.P.Turb.Freq.
B Aft	.5	94	H.P.Turb.Freq.
C Fwd	Negl	-	-
C Aft	.25	94	H.P.Turb.Freq.
D	.5	94	H.P.Turb.Freq.

# Machinery Room #2

STA	Direction + S. A. Mills			CPS	Shaft RPM	Remarks
	Vertical	Athwart	Fore & Aft			
A	.25	10	Trace	51	190	H.P. Turb. freq.
B	.2	negl	negl	51	190	H.P. Turb. freq.
C	negl	negl	negl	-	190	-
D	negl	negl	negl	-	190	-
E	negl	negl	negl	-	190	-
F	negl	negl	negl	-	190	-
G	negl	negl	negl	-	190	-
H	negl	negl	negl	-	190	-
I	negl	negl	negl	-	190	-
A	.9	1.3	.25	66	247	H.P. Turb. freq.
B	.25	.25	-	66	247	H.P. Turb. freq.
	-	.8	6	16		prop. blade freq.
C	1	-	-	16	247	prop. blade freq.
	-	.3	.5	66		H.P. Turb. freq.
D	negl	negl	negl	-	247	- -
I	negl	negl	negl	-	247	- -
A	.25	1.1	.5	84	315	H.P. Turb. freq.
	2.5	4.5	.2	22		prop blade freq.
B	negl	.6	.25	84	315	H.P. turb. freq.
	4	4	1.5	22		prop blade freq.
C	3.5	2.5	5	5.5	315	Shaft Freq.
D	5.5	negl	negl	5.5	315	Shaft freq.
	negl	1.25	2.5	22		prop blade freq.
E	negl	1.25	1.25	22	315	prop blade freq.
F	negl	2.0	5.5	5.5	315	Shaft freq.
	18	1.5	negl	22		prop blade freq.
G	negl	negl	Trace	84	315	H.P. Turb. freq.
	1	.8	negl	22		prop blade freq.
H	1	1.5	1	22	315	prop blade freq.
I	1.5	6	1	22	315	prop blade freq.

**Vibration Data**  
**25, 26 April 1962**

**Machinery Room #1**

STA	Direction + SA Mils			CPS	Shaft RPM	Remarks
	Vertical	Athwart	Fore & Aft			
A	.3	2.1	Trace	84	315	H.P. Turb. Freq.
	1.5	3	2.0	11		2nd Order Shaft
B	.2	.4	-	84	315	H.P. Turb. Freq.
C	negl	.2	-	84	315	H.P. Turb. Freq.
I	negl	1	negl	22	315	prop blade freq.

**Machinery Room #2**

STA	Direction + SA Mils			CPS	Shaft RPM	Remarks
	Vertical	Athwart	Fore & Aft			
A	.5	1.1	-	84	315	H.P. Turb. Freq.
B	negl	.6	.3	84	315	H.P. Turb. Freq.
F	.8	2.0	4.0	22	315	prop blade freq.
I	1.5	5	1	22	315	prop blade freq.

UNDERWAY VIBRATION SURVEY  
HULL AND MAIN PROPULSION MACHINERY  
USS PUTNAM (DD757)  
VIBRATION SURVEY REPORT NO. 240-34  
4 June 1962  
by  
M. MEREND AND O. RITTER

APPROVAL INFORMATION

Authority: J.O. 16-058-0818-99

Prepared by	Checked by	Approved by	Date
M. Merend <u><i>M</i></u>	<u><i>A. S.</i></u>	<u><i>R. M. Scham</i></u>	<u>6/19/62</u>
O. Ritter <u>OKR</u>			

Distribution

C.O. USS Putnam (DD 757)  
212(3) 251D  
232 264B  
239 (2) 271A  
244 304  
245 Tech. Lib. w/orig.

1. Brief Summary:

An underway vibration survey was conducted on the hull, main turbines, reduction gears, shafting and propellers during pre-repair sea trial on the USS PUTNAM (DD757). The ship left the Naval Operating Base at Norfolk Va. at 0700 4 June 1962 and returned at 2200 4 June 1962. The results indicate a satisfactory condition with respect to vibration in the areas inspected.

2. PERSONNEL CONTACTED:

LT. LEMAR  
LT. BRIDGES

Eng. Off. (DD 757)  
Ship Supt. NAVSHIPYD, NYK

3. DETAILS OF SURVEY

a. The main propulsion shafting and propeller survey was conducted utilizing a Universal Askania Vibrograph set for 20:1 magnification. Data was recorded in the athwartships direction at the base of the main gun director foundation (02 level-Frame 74) near the bridge. This location is considered to be reference points for this class ship (DD692) class. Readings were taken at 10 shaft RPM (SRPM) intervals through the range 150 SRPM to 330 SRPM with 5 SRPM intervals through the critical ranges.

b. Each propulsion unit consists of an H.P. and L.P. turbine flexibly connected to double reduction articulated gears. The cruising turbine is connected to the H.P. turbine by means of a single reduction gear and pinion. The main propulsion engine and reduction gear vibration survey was conducted on both #1 and #2 main engines and reduction gears with an Askania Hand Vibrograph, utilizing a 20:1 feeler tube. Data was recorded at all bearings in the three principal directions while the shaft was operating at 315 rpm.

c. The ships force reported vibration at 232 SRPM, however no appreciable vibration was found at this speed.

4. RESULTS:

a. Analysis of the hull data indicates satisfactory condition of the main propulsion shafting and propellers from the standpoint of vibration. The maximum singular vibratory displacement amplitude recorded was  $\pm$  6 Mils at 315 SRPM as shown on the graph on page 4.

This value is well below the accepted maximum of  $\pm$  20 Mils for this class ship. Traces of fourth order (propeller frequency) were recorded in the lower speed range. In addition, traces of a 5.5 cps, hydrodynamically excited constant frequency was experienced in the upper speed range. This vibration is a function of rudder toe angle, and is peculiar to this class ship.



4. RESULTS (CONT'D)

b. Analysis of the main propulsion machinery data indicates satisfactory condition of the main turbines and reduction gears. The maximum singular vibratory displacement amplitude recorded was  $\pm 4.5$  MILS at the #1 cruising turbine reduction gear at 22 cps. (propeller blade frequency) in the vertical direction. This is a propeller blade induced vibration and is not considered excessive.

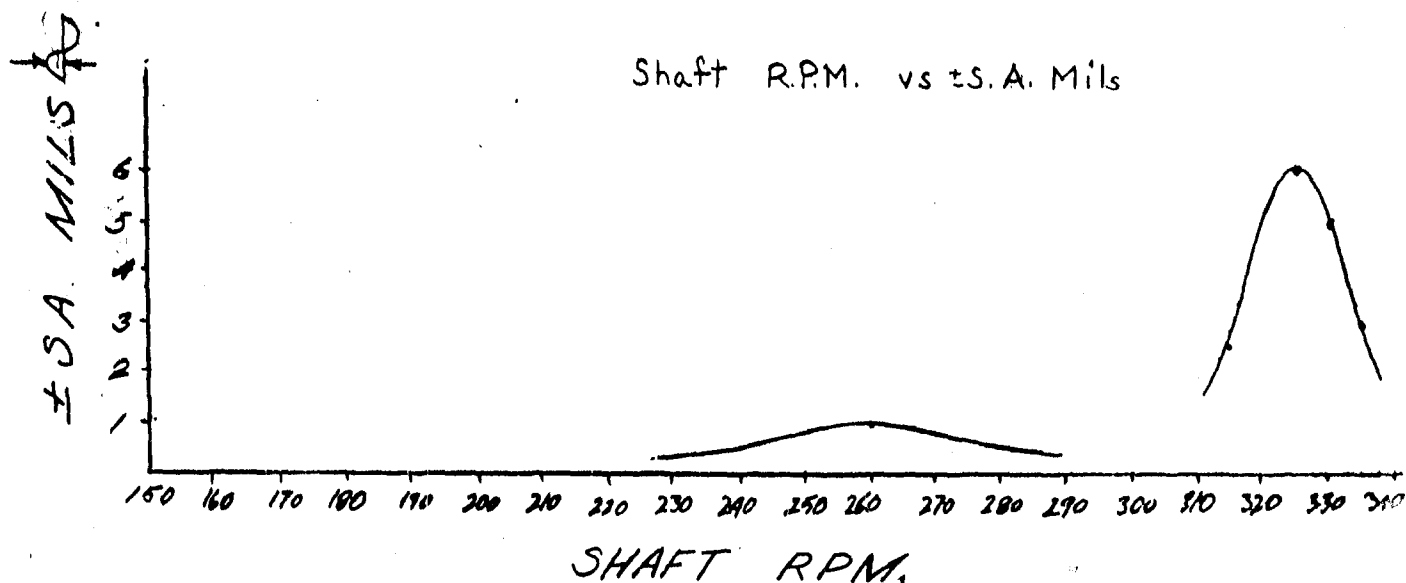
5. CONCLUSIONS:

a. From the standpoint of vibration, the hull, main turbines, reduction gears, shafting and propellers are satisfactory and no work is required.

6. Advanced information given to Code 212 on 9 June 1962.

HULL VIBRATION DATA  
USS PUTNAM (DD757)  
ATHWARTSHIPS DIRECTION

Shaft RPM	CPS.	± SA Mils	Remarks	Shaft RPM	CPS.	± SA Mils	Remarks
150	-	negl	-	270	-	negl	-
160	-	negl	-	280	-	negl	-
170	-	negl	-	285	-	negl	-
180	-	negl	-	290	-	negl	-
190	-	negl	-	295	-	negl	-
200	-	negl	-	300	-	negl	-
210	-	negl	-	305	-	negl	-
220	-	negl	-	310	-	negl	-
225	-	negl	-	315	5.5	2.5	Shaft freq
230	-	negl	-	320	-	negl	-
235	-	negl	-	325	5.5	6	Shaft freq.
240	-	negl	-	330	5.5	5	Shaft freq.
260	4.5	1.0	Shaft freq.	335	5.5	3	Shaft freq



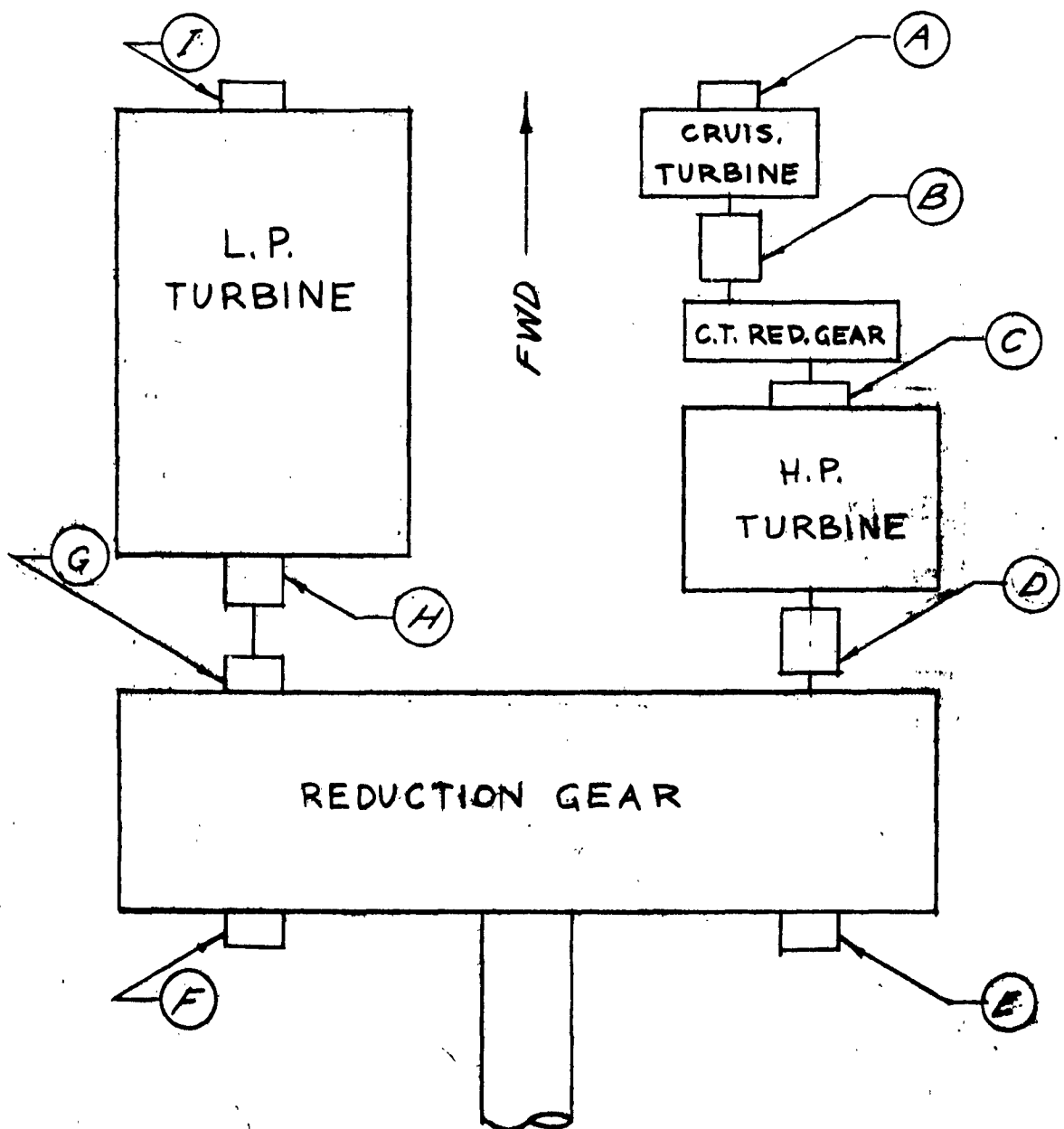
VIBRATION DATA  
MAIN MACHINERY ROOM NO.1

STA	DIRECTION $\pm$ SA Mils			CPS	Shaft RPM	Remarks
	Vertical	Athwart.	Fore & Aft			
A	Trace	negl	Trace	22	315	prop.blade freq.
B	negl	Trace	negl	22	315	prop.blade freq.
C	negl	negl	negl	-	315	- - -
D	negl	negl	negl	-	315	- - -
E	negl	negl	negl	-	315	- - -
F	negl	negl	negl	-	315	- - -
G	negl	negl	negl	-	315	- - -
H	negl	negl	negl	-	315	- - -
I	negl	1.5	Trace	22	315	prop.blade freq.

MAIN MACHINERY ROOM NO.2

STA	DIRECTION $\pm$ SA Mils			CPS	Shaft RPM	Remarks
	Vertical	Athwart.	Fore & Aft			
A	1.0	3.0	1.0	22	315	prop.blade freq.
B	4.5	negl	1.0	22	315	prop.blade freq.
C	3.5	negl	negl	22	315	prop.blade freq.
D	negl	0.5	1.0	22	315	prop.blade freq.
E	negl	0.5	negl	22	315	prop.blade freq.
F	Trace	Trace	Trace	22	315	prop.blade freq.
G	negl	negl	1.0	22	315	prop blade freq.
h	negl	negl	3	22	315	prop.blade freq.
I	.5	3	1	22	315	prop blade freq.

DATA STATIONS  
USS PUTNAM  
DD 757



UNDERWAY VIBRATION SURVEY  
HULL, SHAFTING AND PROPELLERS  
USS DeLONG (DE684)  
VIBRATION SURVEY REPORT NO. 240- 35

6 September 1962

by

R. BAUMAN AND O.K. RITTER

APPROVAL INFORMATION

Authority: J.O. 16-058-0818-99

Prepared by	Checked by	Approved by	Date
R. Bauman <u>Rob</u>	<u>A.P.</u>	<u>[Signature]</u>	<u>9/6</u>
O. Ritter <u>OKR</u>			

DISTRIBUTION  
C.O. USS DeLONG (DE 684)  
1200  
1225  
1227-6)  
264B  
244C  
245 Tech. lib@w/orig.

**1. Brief Summary:**

An underway vibration survey was conducted on the hull, shafting and propellers during pre-repair sea trials of the USS DeLong, (DE 684). The ship left the Naval Reserve Base at Fort Schuyler at 0900 and returned at 1300 6 Sept 1962. The results indicate a misalignment in the shafting.

**2. Personnel Contacted:**

Lt. Cdr. McGrave  
Lt. Chapman

C.O. of DE 684  
Engineering Officer DE 684

**3. Details of Survey**

a. The main propulsion shafting and propeller survey was conducted utilizing a Universal Askania Vibrograph set for 20:1 magnification. Data was recorded in the athwartships direction at the Fantail centerline, 3 feet forward of the Ensign Staff. Initial readings were taken at 10 SRPM (Shaft revolutions per minute) intervals between the speed range of 150 SRPM and 385 SRPM with 5 SRPM intervals through the critical ranges (Approx. 185 SRPM and 340 SRPM).

4. Analysis of the hull data indicates an unsatisfactory condition of the main propulsion shafting. The maximum singular vibratory displacement amplitude recorded was 18 Mils at 6 Cps (first order with respect to the shaft), which is an indication of shaft misalignment.

**5. CONCLUSIONS:**

a. From the data taken, it is recommended that both shafts be checked for alignment.

6. Advance information was given to code 1225 on 10 Sept 1962.

UNDERWAY VIBRATION SURVEY  
MAIN PROPULSION MACHINERY  
USS ESSEX (CVS9)  
VIBRATION SURVEY REPORT NO. 240-36  
4, 5 September 1962 & 12, 13 September 1962  
by  
R. BAUMAN, M. MEREND AND O. RITTER

APPROVAL INFORMATION

Authority: J.O. 30-375-8100-99

Prepared by

Checked by

Approved by

Date

R. Bauman *RB*

*R.B.*

*[Signature]* *[Signature]*

M. Merend *M*

O. RITTER OKR.

DISTRIBUTION:

C.O. USS ESSEX (CVS-9)

212(3) 251D

232 264B

239(2) 271A

244 304

245 Tech lib w/orig(2)

1. BRIEF SUMMARY:

Underway vibration surveys were conducted on the main turbine and reduction gears during the builders trials, 4, 5 Sept 1962, and preliminary acceptance trials 12, 13 Sept 1962 of the USS ESSEX (CVS-9). The results indicate a satisfactory condition with respect to vibration in areas inspected.

2. Personnel Contacted:

Commander Farley

Engineering Officer (CVS-9)

3. Details of Survey

Each propulsion unit consists of a H.P. and a L.P. turbine flexibly connected to double reduction articulated gears. The vibration survey was conducted on #1, #2, #3 and #4 main engine with an Askania Hand Vibrograph utilizing 5:1 and 20:1 feeler tubes. Data was recorded at all bearings in the three principal directions while the shaft was running at 240 RPM. An International Research and Development Vibration Analyzer was used at selected points where additional data was required.

4. RESULTS:

a. Analysis of the main propulsion machinery data indicate a satisfactory condition of the main turbines and reduction gears. The maximum singular vibratory displacement was  $\pm 5$  Mils in the vertical direction on the aft end of the high pressure turbine. The frequency of vibration was 17 cps (fourth order with respect to the shaft), induced by the propeller blades. This vibration is not considered excessive.

5. From the standpoint of vibration the main turbines and reduction gears are satisfactory and no work is necessary.



UNDERWAY VIBRATION SURVEY  
HULL AND MAIN PROPULSION MACHINERY  
USS PARKER (DE 369)  
VIBRATION SURVEY REPORT NO. 240-37

24 September 1962

by  
G. LAZAREK  
M. MEREND  
W. PULEO  
O. RITTER

APPROVAL INFORMATION

Authority: J.O. 30-375-8100-99

Prepared by	Checked by	Approved by	Date
G. Lazarek <u>G.L.</u>	<u>A. Isaacson</u>	<u>Charles Selig</u>	<u>22 Oct</u>
M. Merend <u>M</u>	<u>17 OCT 1962</u>		

W. Puleo WLP

O. Ritter OKR

Distribution  
OO USS PARKER (DE369)  
1200  
1225  
1227-6  
244C  
245 Tech lib w/orig  
264B

1. BRIEF SUMMARY:

An underway vibration survey was conducted on the hull, main turbines, reduction gears, shafting and propellers during the sea trials of the USS PARKER D.E.369. The ship left Port Newark N.J. at 0900 and returned at 1700. The results of the survey indicate a satisfactory condition with respect to vibration in the areas inspected.

2. PERSONNEL CONTACTED

LT. Hart

C.O. USS PARKER DE369

3. DETAILS OF SURVEY

a. The main propulsion shafting and propeller survey was conducted utilizing a Universal Askania Vibrograph set for 20:1 magnification. Data was recorded in the athwartships direction on the fantail five feet forward of the ensign staff. This position is considered to be a reference point for this ship. Readings were taken at 10 shaft RPM (SRPM) intervals through the speed range of 150 SRPM to 390 SRPM with 5 SRPM intervals through the critical speed range (approx. 340 SRPM).

b. Each propulsion plant consists of a hp and lp turbine flexibly connected to a reduction gear. The survey was conducted on both #1 and #2 main engines and reduction gears with an Askania Hand Vibrograph utilizing a 20:1 feeler tube. Data was recorded on all bearings in the three principal directions while the shaft was operating at 360 RPM.

4. RESULTS

a. Analysis of the hull data indicates satisfactory condition of the main propulsion shafting and propellers from the stand point of vibration. The maximum singular vibratory displacement amplitude recorded was + 9 mils at 360 SRPM. This is below the accepted value of  $\pm$  20 mils.

b. Analysis of the main propulsion machinery data indicates satisfactory condition of the main turbines and reduction gears. The maximum singular vibratory displacement amplitude was + 2 mils at the aft end of the LP turbine at 19 cps (propeller blade frequency) in the fore and aft direction.

5. CONCLUSIONS AND RECOMMENDATIONS

From the standpoint of vibration, the hull main turbines, reduction gears, shafting and propellers are satisfactory and no work is required.

6. Advanced information given to code 1225 on 1 Oct. 1962.

UNDERWAY VIBRATION SURVEY  
HULL AND MAIN PROPULSION MACHINERY  
USS COATES (DE 685)

VIBRATION SURVEY REPORT NO. 240- 38  
26 September 1962

by

R. BAUMAN

O. RITTER

APPROVAL INFORMATION

Authority: J.O. 30-375-8100-99

Prepared by

Checked by

Approved by

Date

R. Bauman RB

R. Bauman

Arnold Selzer

29 Oct 62

O. Ritter OKR

Distribution  
CO USS COATES DE685  
1200  
1225  
1227-6)  
244C  
245 Tech Lib w/orig  
264B

1. BRIEF SUMMARY

1. An underway vibration survey was conducted on the hull, main turbines, reduction gears, shafting and propellers during the sea trials of the USS COATES (DE 685). The ship embarked from New Haven at 0700, 26 September 1962 and arrived Earle New Jersey 1800. The results of the survey indicate a satisfactory condition with respect to vibration in the areas inspected.

2. PERSONNEL CONTACTED.

Capt. Hoyt  
Lt. Robinson

C.O. USS COATES (DE 685)  
Engineering Officer (DE 685)

3. DETAILS OF SURVEY.

a. The main propulsion shafting and propeller survey was conducted utilizing an Universal ASKANIA Vibrograph set for 20:1 magnification. Data was recorded in the athwartships direction three feet forward of the Design Staff. This position is considered to be a reference point for this ship. Readings were taken at 10 Shaft RPM (SRPM) intervals through the speed range of 150 SRPM to 370 SRPM with 5 SRPM intervals through the critical range (Approximately 340 SRPM) with both shafts operating at the same speed. Readings were taken on the hull with the starboard shaft turning at 5 SRPM intervals through the speed range of 335 SRPM to 370 SRPM and the port shaft turning at 320 SRPM. Readings were also taken at the same reference point with the port shaft turning at 5 SRPM intervals through the speed range of 335 SRPM to 370 SRPM and the port shaft turning at 320 SRPM.

b. Each propulsion plant consists of a turbine, generator and a motor driving the shaft. The survey was conducted on both main engines using an ASKANIA Hand Vibrograph utilizing a 20:1 feeler tube. Data was recorded on all bearings in the three principal directions while the shaft was operating at 370 RPM.

4. RESULTS.

a. Analysis of the hull data indicates satisfactory condition of the main propulsion shafting and propellers from the standpoint of vibration. The maximum singular vibratory displacement amplitude recorded was + 16 Mils at 345 SRPM. This is below the accepted value of + 20 Mils. The hull data is plotted on page 3.

b. Analysis of the main propulsion machinery data indicates satisfactory condition of the main turbines, generators and motors. The maximum singular vibratory displacement amplitude was + 2 Mils at the aft end of the #2 generator in the athwartships direction, at 24 cps. (propeller blade frequency).

BRIEF SUMMARY - (Cont'd)

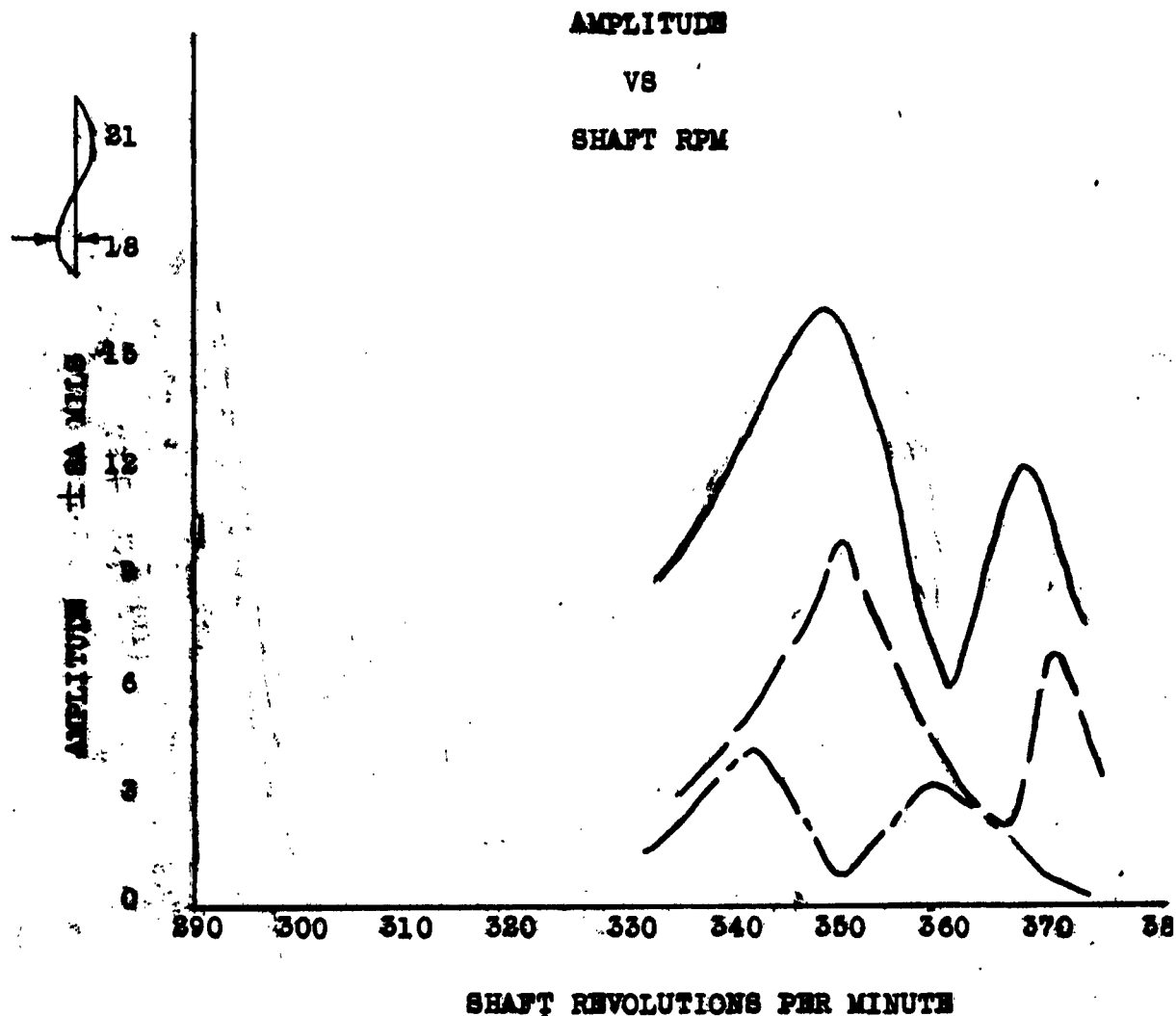
5. CONCLUSIONS AND RECOMMENDATIONS:

a. From the standpoint of vibration, the hull, main turbines, main propulsion generators and motors, shafting and propellers are satisfactory and no work is required.

6. Advance information sent to Code 1227 on 1 October 1962.

26 SEPT. 62

O. RITTER



- • BOTH SHAFTS OPERATING AT THE SAME SRPM.
- × STBD. SHAFT AT 320 SRPM, PORT SHAFT SRPM VARYIN
- ⊙ PORT SHAFT AT 320 SRPM, STBD. SHAFT SRPM VARYIN

UNDERWAY VIBRATION SURVEY  
HULL AND MAIN PROPULSION MACHINERY  
USS RICH, (DD-820)

VIBRATION SURVEY REPORT NO. 240-39  
23 October 1962  
BY

M. MEREND

O. RITTER

APPROVAL INFORMATION

Authority: J.O. NO. 13-258-8001-99

Prepared by:

Checked by:

Approved by:

Date:

M. Merend

*m*

*a.f.*

*Amold [Signature]*  
*267*

*22 Dec*

O. Ritter

*OKR*

DISTRIBUTION

C.O. USS RICH (DD820)

212 (3) 251D

232 264B

239 271A

244 304

2450 Tech. Lib w/orig

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Vibration Data (Main Machy Rm #1) - - - - -	3
Vibration Data (Main Machy Rm #2) - - - - -	3
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## 1. BRIEF SUMMARY

An underway vibration survey was conducted on the hull, main turbines, reduction gears, shafting and propellers during pre-repair sea trial on the USS RICH (DD-820). The ship left Portsmouth Naval Shipyard in Virginia at 0600, 23 October 1962 and returned to the Naval Operating Base at Norfolk, Virginia at 1930, 23 October 1962. The results indicate a satisfactory condition with respect to vibration in the areas inspected.

## 2. PERSONNEL CONTACTED

CDR. Mason  
LTJG Peace

C.O. USS RICH (DD-820)  
Eng. Off. USS RICH (DD-820)

## 3. DETAILS OF SURVEY

Draft: 13' 2" forward  
Displacement: 3,252 tons

14' 3" aft

a. The main propulsion shafting and propeller survey was conducted utilizing a Universal Askania Vibrograph set for 20:1 magnification. Data was recorded in the athwartships direction at the base of the main gun director (O2 level-frame 74) near the bridge. This location is considered to be a reference point for this class ship (DD-692 class). Reading were taken at 10 shaft RPM (SRPM) intervals through the range 190 SRPM to 345 SRPM with 5 SRPM intervals through the critical range.

b. Each propulsion unit consists of an h.p. and l.p. turbine flexibly connected to a double reduction articulate gear. The cruising turbine is connected to the h.p. turbine by means of a single reduction gear and pinion. The main propulsion engine and reduction gear vibration survey was conducted on both #1 and #2 main engines and reduction gears, with an Askania Hand Vibrograph utilizing a 20:1 feeler tube. Data was recorded at all bearings in the three principal directions while the shaft was operating at 315 rpm.

## 4. RESULTS.

a. Analysis of the hull data indicates a satisfactory condition of the main propulsion shafting and propellers from the standpoint of vibration. The maximum singular vibratory displacement amplitude recorded was + 4 mils at 320 SRPM as shown on the graph on page 2. This value is well below the accepted value of + 20 mils.

b. Analysis of the main propulsion machinery data indicates satisfactory condition at the main turbines and reduction gears. The maximum singular vibratory displacement amplitude was + 3.5 mils at the forward end of the #2 cruising turbine reduction gear at 22 cps (propeller blade frequency) in the vertical direction. This is propeller blade induced vibration and is not considered excessive.

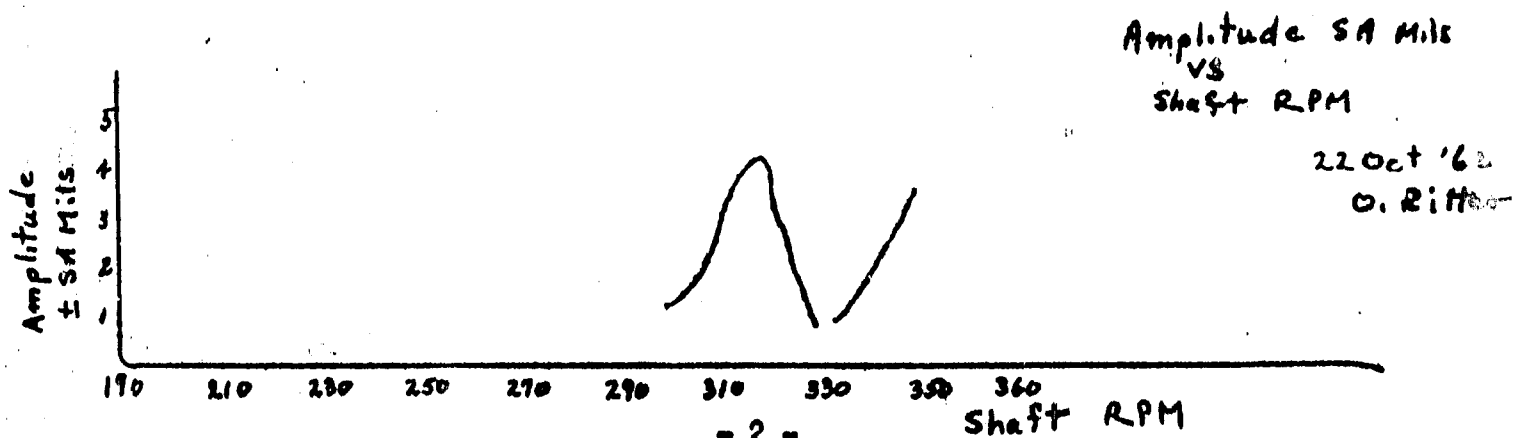
5. CONCLUSIONS.

a. From the standpoint of vibration the hull, main turbines, reduction gears shafting and propellers are satisfactory and no work is required.

Advanced information given to Code 212 on 25 October, 1962.

HULL VIBRATION  
USS RICH (DD-820)  
ATHWARTSHIPS DIRECTION

SHAFT RPM	CPS	+ SA Mils	REMARKS	SHAFT RPM	CPS	+ SA Mils	REMARKS
190	--	neg		280	--	neg	
200	--	neg		290	--	neg	
210	--	neg		300	5	1	shaft freq.
220	--	neg		310	5	3.5	shaft freq.
230	--	neg		320	5	4	shaft freq.
240	--	neg		330	5.5	2.5	shaft freq.
250	--	neg		335	5.5	1.5	shaft freq.
260	--	neg		340	6	2.5	shaft freq.
270	--	neg		345	6	3.5	shaft freq.



# VIBRATION DATA

## MAIN MACHINERY ROOM NO. 1

STA	Direction $\pm$ S.A. Mils			CPS	SHAFT RPM	REMARKS
	Vertical	Athwart.	Fore & Aft			
A	Neg	neg	neg	-	345	-----
B	neg	neg	neg	-	345	-----
C	neg	neg	neg	-	345	-----
D	neg	neg	neg	-	345	-----
E	neg	neg	neg	-	345	-----
F	neg	neg	0.75	22	345	prop blade freq.
G	neg	neg	neg	-	345	-----
H	neg	neg	neg	-	345	-----
I	neg	neg	neg	-	345	-----

## MAIN MACHINERY ROOM NO. 2

STA	Direction $\pm$ S.A. Mils			CPS	SHAFT RPM	REMARKS
	Vertical	Athwart.	Fore & Aft			
A	neg	neg	0.75	22	345	prop blade freq.
B	3.5	2.5	neg	22	345	prop blade freq.
C	2.5	neg	neg	22	345	prop blade freq.
D	neg	neg	neg	-	345	-----
E	neg	neg	0.5	22	345	prop blade freq.
F	neg	neg	neg	-	345	-----
G	neg	neg	neg	-	345	-----
H	neg	neg	neg	-	345	-----
I	neg	2.0	neg	22	345	prop blade freq.

UNDERWAY VIBRATION SURVEY  
HULL AND MAIN PROPULSION MACHINERY  
USS MACKENZIE (DD836)  
(PRE-FRAM TRIAL)

VIBRATION SURVEY REPORT NO. 240 - 40  
13 December 1962

by

J. PENN and V. PULEO

APPROVAL INFORMATION

Authority:

Prepared by

J. Penn

V. Puleo

Checked by

A. L. L. L.

Approved by

Amel Selby  
Code 244 (out 3)

Date

14 Jan 63

DISTRIBUTION:

CO USS MACKENZIE (DD836)

1200

1225

1227-(6)

244C

245 TECH LIB w/ORIG

264B

1. Brief Summary:

An underway vibration survey was conducted on the hull, main turbines, reduction gears, shafting and propellers during the pre-fram sea trial of the USS MACHENZIE (DD836). The ship embarked from the New York Naval Shipyard at 0600, 13 December 1962 and arrived back at the New York Naval Shipyard at 1830 of the same day. Evaluation of the data on the survey yields a satisfactory condition of the propulsion plant. Although the overall hull vibration is within the allowable limits, the port shaft and propeller vibration contribution is excessive as compared to the starboard shaft and propeller.

2. Personnel Contacted:

Capt. J. K. Leslie  
Lt. Lazarchick  
Lt. McKenzie

CO USS MACKENZIE (DD836)  
Engineering Officer (DD836)  
Ship Supt. N.Y.N.S.

3. Details of Survey:

a. Operating Conditions

Fwd. Draft	11ft. 6 inches
Aft. Draft	12ft. 6 inches
Mean Draft	12ft.
Displacement	2700 tons
Propellers	four bladed NACABS

b. The response of the hull girder to exciting forces acting on the hull directly was investigated. This investigation was conducted utilizing a Universal Askania vibrograph set for a 20:1 magnification. Data were recorded in the athwartship direction at the base of the main gun director foundation, fr. 72  $\phi$  on the 02 level near the bridge. This location is essentially antinodal and generally responsive to transverse excitation at the 3 noded critical of about 246 cpm and responsive to the single node torsional critical of about 310 cpm. During the survey large amplitudes of vibration were discovered in the 245 SRPM range. Although large amplitudes were expected (in this vicinity), the wave form tended to alter its shape and it was felt further investigation would be informative and non-detrimental. It was decided upon completion of the "Build Up to 80% Full Power" that a determination of the contribution of each propeller-shaft to the overall vibration would be helpful. Thus single shaft runs were made in the lower critical speed range.

The data as recorded at speed increments of 10 shaft RPM (5 shaft RPM through critical speeds) can be seen on pages 4 & 5.

c. Each propulsion unit consists of an H.P. and L.P turbine flexibly connected to double reduction articulated gears. The cruising turbine is connected to the H.P. turbine by means of a single reduction gear and pinion. The survey was conducted in both main engine rooms utilizing an Askania Hand vibrograph with a 20:1 set magnification. Data were recorded in both engine rooms while the ship maintained a constant 330 SRPM, except as noted on pages 5 & 6. Recordings were made at bearings in the 3 principal directions. (Location of bearings shown in sketch on page 3)

#### 4. Results:

a. Analysis of the overall hull data indicates satisfactory condition of the main propulsion shafting and propellers from the standpoint of vibration. The maximum singular vibratory displacement is 5 mils at 245 SRPM, is within the accepted limits for this class of ship. For the individual shaft-prop vibration contribution to the overall hull vibration, the starboard prop-shaft readings appeared as pure first order and sinusoidal in form. However, the port prop-shaft vibration readings had larger amplitudes ( 3 to 4 mils at 245 SRPM ) with a trace of second order wave forms. The plot of displacement vs. frequency for all hull vibration readings may be seen on page 7.

b. Analysis of the main propulsion machinery data indicates satisfactory condition of the main turbines and reduction gears. The maximum vibratory amplitude was recorded in No. 2 Engine Room and was  $\pm 3.75$  mils at fourth order (prop.) frequency.

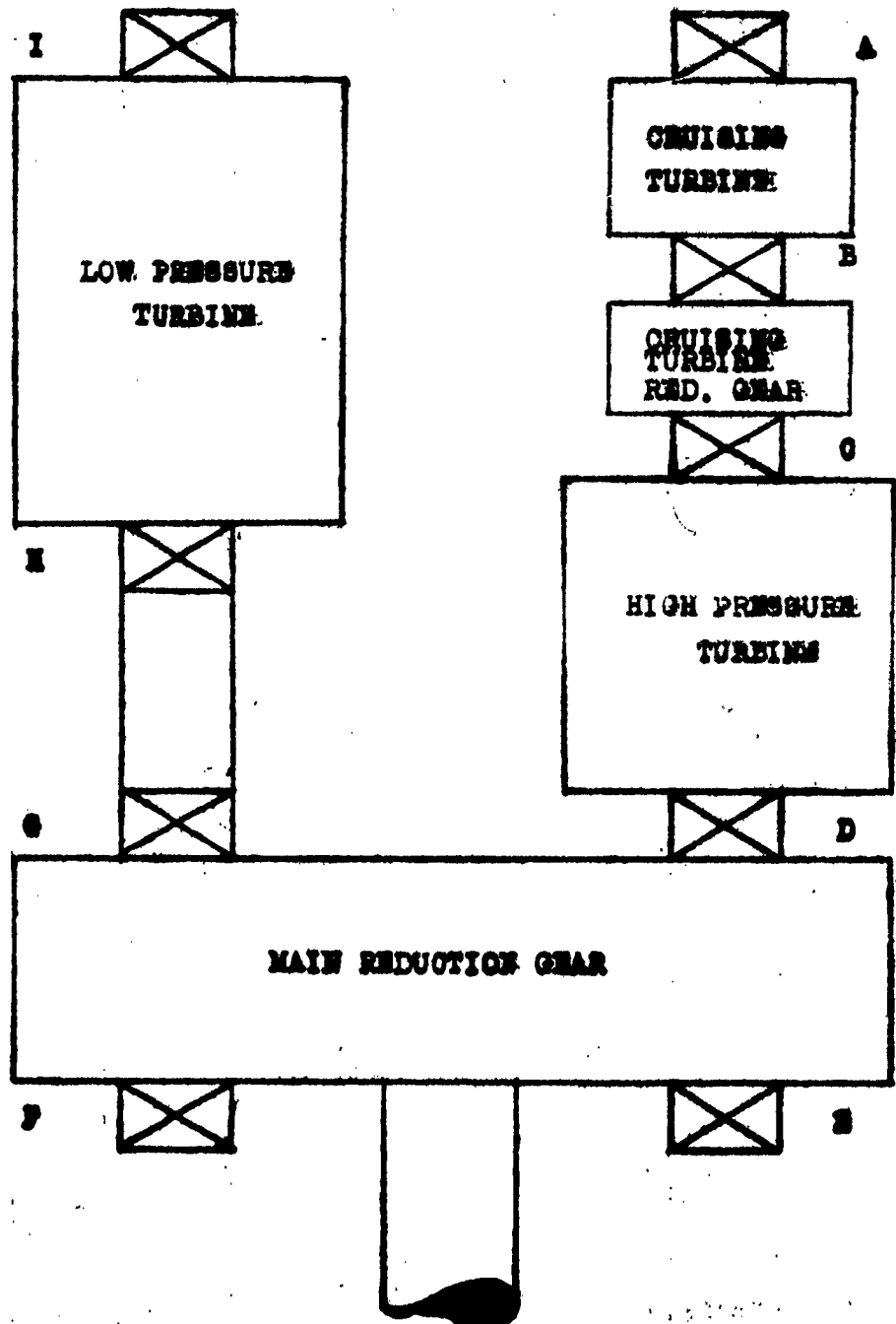
#### 5. Recommendation and Conclusions:

1. Check port propeller for pitch and balance
2. Check bearing clearances and alignment of the port shaft.

The above recommendations are thought necessary to reduce the amplitude of the port prop-shaft vibration contribution. The starboard prop-shaft unit is satisfactory and no work should be done on it for vibration purposes.

**DATA STATIONS FOR MACHINERY SPACES**

**(NO. 2 ENGINE ROOM)**



# HULL VIBRATION DATA - ATHWARTHSHIP DIRECTION

SHAFT RPM	FREQ. CPS	DISPLACEMENT + MILS	REMARKS
58-120	-	negl.	-
130	9	.250	Prop. blade frequency
140	9.5	.313	" " "
150	10.5	.375	" " "
160	11	.38	" " "
170	-	negl.	-
180	-	negl.	-
190	-	negl.	-
200	-	negl.	-
210	-	negl.	-
220	3.77	1.25	Shaft freq. & 2nd order trace
230	3.83	2.12	" " " "
235	3.92	5	" " " "
240	4.00	9.25	" " " "
245	4.08	15	" " " "
250	4.17	12.75	" " " "
260	4.33	12.5	" " " "
270	4.50	3.12	" " " "
280	4.67	2.5	" " " "
290	4.83	1.75	" " " "
300	5.00	2.75	" " " "
305	5.08	3.5	" " " "
310	5.17	5.6	" " " "
315	5.25	6.9	" " " "
320	5.33	12	" " " "
330	5.50	12.1	" " " "



**DD836 - USS MACKENZIE**  
**PRE-FRAM TRIAL OF 12/13/62**  
**HULL VIBRATION DATA**  
**ATHWARTSHIPS DIRECTION**

**TRAIL SHAFT READINGS**

SHAFT RPM		FREQ. CPS	DISPLACEMENT + Mils	Remarks
PORT	STBD			
240	210	4	3.5	Shaft freq. & 2ND order
245	210	4.08	8.87	" " " "
250	210	4.17	10.4	" " " "
210	240	4	1.75	Shaft Freq.
210	245	4.08	2.88	" "
210	250	4.17	2.38	" "

**MACHINERY SPACE VIBRATION DATA**

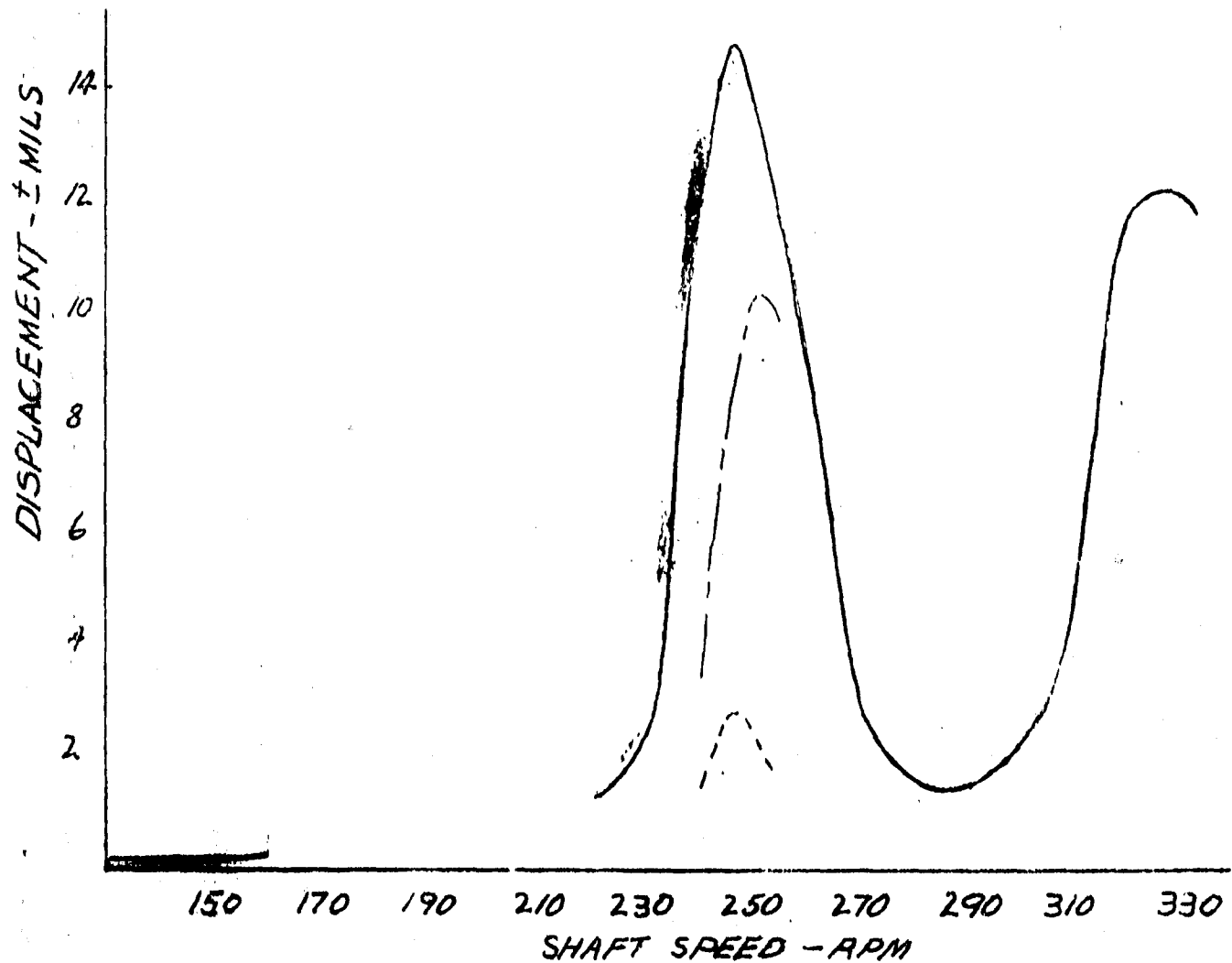
**ENGINE ROOM #1**

STA.	DISPLACEMENT			FREQ. CPS	SHAFT RPM	REMARKS
	VERT.	ATH	FGA			
A	.250	.250	.500	22	330	Prop. freq.
B	.625	negl.	negl.	22	330	" "
C	negl.	negl.	.375	22	330	Prop. freq.
D	negl.	negl.	negl.	-	330	-
E	negl.	negl.	negl.	-	330	-
F	negl.	negl.	negl.	-	330	-
G	negl.	negl.	negl.	-	330	-
H	negl.	negl.	negl.	-	330	-
I	.375	.500	.500	22	330	Prop. freq.

DD836 - USS MACKENZIE  
PRE-FRAM TRIAL OF 12/13/62  
MACHINERY SPACE VIBRATION DATA  
ENGINE ROOM #2

STA	DISPLACEMENT			FREQ CPS	SHAFT RPM	REMARKS
	VERT.	ATH	F&A			
A	negl.	negl.	.875	22	330	Prop. Freq
B	3.750	.625	negl.	22	330	" "
C	3.750	3.500	1.625	22	330	" "
D	negl.	negl.	negl.	-	330	-
E	negl.	negl.	1.25	22	330	Prop. freq.
F	1.000	2.122	1.375	21-20	315-300	" "
G	negl.	1.500	1.250	20	300	" "
H	1.000	.750	1.125	20-19	300-285	" "
I	1.500	.625	1.000	22	330	" "

# DISPLACEMENT VS SHAFT SPEED



- BOTH SHAFTS AT SAME SPEED
- ——— PORT SHAFT VARIED, STB'D HELD CONSTANT
- - - - - STB'D SHAFT VARIED, PORT HELD CONSTANT